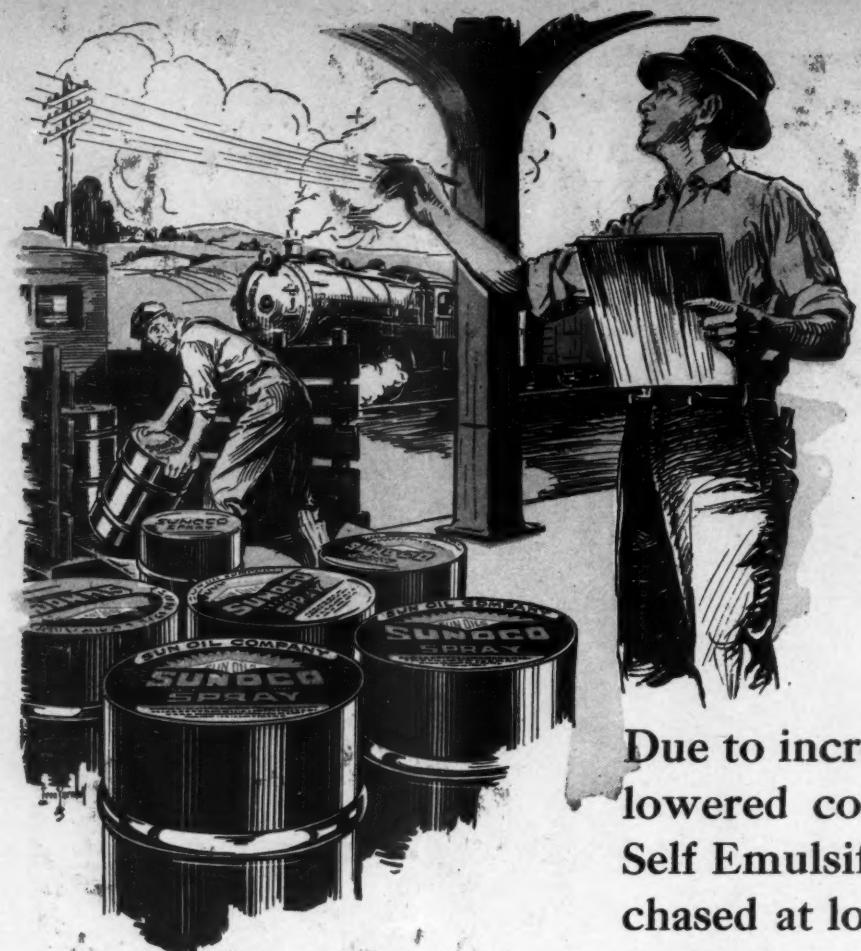


# AMERICAN FRUITGROWER MAGAZINE



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# American Fruit Grower

## MAGAZINE

The National Fruit Journal of America

VOLUME 50

NUMBER 2

### A Year of Progress

IT IS DOUBTFUL if any one year in the history of the American fruit industry reflects more progress in control of insects and plant diseases than does the year 1929.

Not that research in problems of pest control became suddenly active during the year, though an increase in such activity was evident on all sides. Most of the outstanding accomplishments of 1929 were but the culmination of labor through many preceding years.

Probably the most outstanding accomplishment of the year was the handling of the situation created by the discovery of the Mediterranean fruit fly in Florida. A survey by a group of competent specialists set up the procedure most likely to be effective. The men, materials and money, fortunately, were at hand to carry out the suggested procedure. Another survey by an entirely different group of specialists made a few months later pronounced the pest to be apparently eradicated.

A victory of this kind can only crown co-ordinated endeavor properly directed. But that such a victory can be gained at all gives food for thought. We have other pests that merit extermination.

The oriental fruit worm might well be studied with the view of making a project of its extermination. Whatever the cost of such a project, the amount in all likelihood would be far less than the annual cost of the insect to the peach growers. And the fruit worm presents no greater problem than did the fruit fly.

Following the successful outcome of a war of extermination against the fruit worm, other similar projects against other important fruit pests would be in order. Apple scab might well come in for thoughtful consideration.

But in all such projects one important item should not be overlooked—the status of the individual grower. He should be reimbursed for capital loss.

Until such time as major fruit enemies can be treated as common enemies and subjected to a war of extermination, the individual grower will of necessity give some close study to the subject of better methods and materials.

Better materials, more effective and safer than the old, have been developed and have proved their value. They are being more readily received by growers in general, who are realizing the necessity for more effective weapons against the enemies of their crops.

The subject of adequate equipment is likewise to the fore. Unless the tree is completely covered, the most effective material is of lessened value. Speed and thoroughness in coverage demands sprayers and dusters of adequate capacity. Too many orchards have out-grown their equipment.

But with the best of materials and equipment, the result in clean, marketable fruit will always depend upon the intelligent effort of



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the grower himself. Timeliness and thoroughness require watchfulness and effort. The grower who succeeds is the one who knows why he is performing a given operation, and to know why, he must make some study of the

life habits of the more important insects, and be familiar with the development of the more important fungi likely to infest his fruit plantings.

In this, the "Spray Number" of AMERICAN FRUIT GROWER MAGAZINE for 1930, we present to our readers the outstanding developments of 1929 in the control of insects and diseases affecting fruit crops. The articles in this issue represent basic accomplishments, they deal with fundamentals. They should furnish material for reference throughout the year in meeting the problems of control.

As the various spray operations suitable to each major fruit are discussed in later issues, it will be well for the reader to preserve this issue, as frequent reference, in all likelihood, will be made to articles appearing herein as the application of principles discussed becomes timely.

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**WE ALL UNDERSTAND** that most of the progress that is made in human achievement and efficiency is the result of economic forces. That is inevitable. It is true that some big advances in the welfare of the human race arise from disinterested activities: in medicine, for instance, and philanthropic enterprises, and often in the fine arts. But taking the whole field of human activity, most of our progress has an economic spring to drive it. Furthermore—and this is important—it would never make the headway that it exhibits except for that driving force.

Take an example. A short time ago the whole world celebrated the semi-centennial of the electric light and gave well-earned recognition to its great inventor, Edison. We have made enormous strides in recent years in the use of electricity for lighting. I don't know how many men have contributed to that wonderful advancement, but the number must be in the thousands. There is one research laboratory alone, which I have visited, where scores of men are at work on perfecting the utilization of electrical energy. Behind all this there is the driving force of economic considerations. There has been hard work, too, and idealism, and the pioneering mind of which Edison is the great example. But the greater part of the push has come from the economic side—factories to build and expand, dividends to make, competitions to meet.

And so it goes with most human activities.

#### Why Progress Lagged in Spray Chemicals

**BUT THE WARFARE** against pests has been on a different footing. Economic forces have operated there only sparingly; that is, sparingly as compared with other human enterprises.

The grower has felt the pressure and felt it strongly. He has found insects and diseases taking toll of crops and cutting into his profits. But except in a few regions of the United States, growers have not been organized in such way, or on such scale, as to undertake extensive pioneering in devising better warfare. They have faced a condition in which all that they could do was to adopt the measures that they could learn of and let it go at that.

To a certain extent, in the past, manufacturers have found an economic advantage in striking out for better sprays. Some of them have shown a fine spirit of enterprise. But there has been much more to accomplish than they could undertake, especially in the way of far-reaching, fundamental studies, such as are needed for substantial advance in means of warfare.

#### Changing Conditions Demand Greater Effectiveness

**A FEW YEARS AGO** a change began to appear and we entered upon an era in which our warfare against pests is steadily developing as it had never developed before. It is clearly becoming evident as a definite movement.

There were certain conditions that gave it its start. For one thing, we have brought upon ourselves a visitation of enormously destructive insects and plant diseases, introduced here from other countries. Many that might be established we have so far kept out. Others are securely here and here to stay. Some of the latter are only now beginning to make themselves felt as a danger of national scope, for the reason that they have been confined to limited areas at the start. By and large, we have an array of dangerous insects and plant diseases to contend with that is quite ample to stir us up. One only needs to mention such pests as the Japanese beetle, the Mediterranean fruit fly, and various others to point the moral.

Along with this, the consuming public desires and requires continually higher standards in the fruits and produce that it buys. Once in a while we get a glimpse of the grades of fruit that our grandfathers were willing to put up with. The American public today has moved a long way in the standards that it demands.

In brief, it has become necessary to fight an increased number of serious pests and to do it more successfully than it has been done in the past. That is a large undertaking.

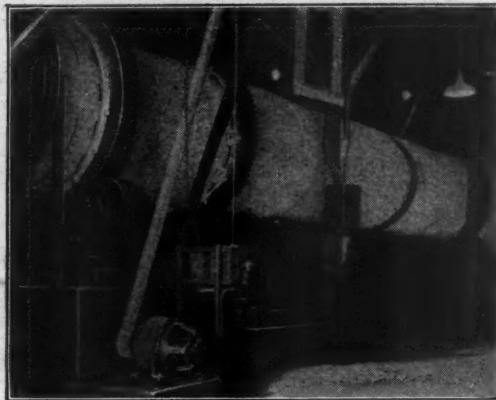
Until recent years many of our resources in the way of sprays represented more or less chance materials.

# UNDERMINING THE ENEMY

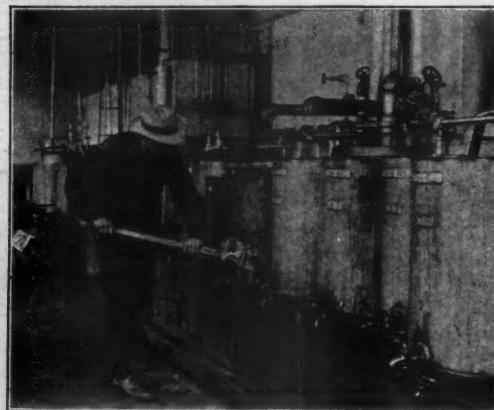
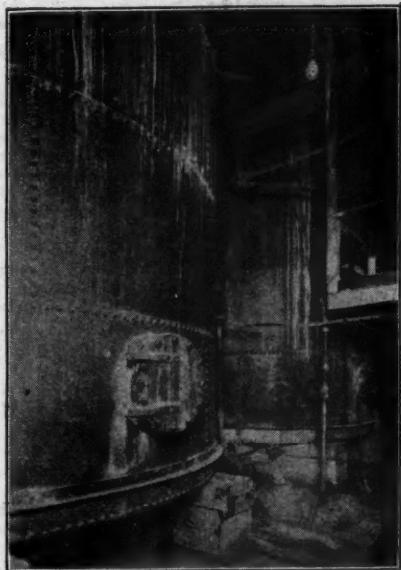
*Many Agencies Are Engaged in the Search for More Effective Weapons to Be Used in the Warfare Against the Enemies of the Nation's Food Crops. The Chemist, Entomologist and Plant Pathologist Are Guiding the Manufacturer in the Production of Effective Chemicals*

By WALTER COLLINS O'KANE

Chairman, Board of Governors, The Crop Protection Institute, Professor of Entomology, University of New Hampshire



*The investment in manufacturing equipment for the production of better sprays and dusts mounts into the millions of dollars. The steadily widening market for the more effective and safer materials now produced commercially is an incentive to manufacturers to continue their extensive research for still better products. Thus science and industry are co-operating to the benefit of agriculture*



Some of them were pure chance. Some were lucky thoughts. Some were just a guess. Paris green for a poison, lime-sulphur for a winter spray—these were chance or guess.

#### Systematic Research for Effective Weapons

**A FEW YEARS AGO** a definite movement set in, looking toward a much more far-reaching organization of chemical knowledge for the fighting of insects and plant diseases. In this movement the United States Department of Agriculture, various State experiment stations, and various

chemical manufacturers have shared. Month by month it has been growing. Steadily it is reaching out and accumulating knowledge that we have needed for decades. Already it has yielded some new and effective weapons in the way of sprays, dusts, and fumigants. And there is no doubt but that we are only fairly started.

In the laboratories of the United States Department of Agriculture work is going on that is far beyond anything hitherto conceived. Able chemists have been linked up with competent entomologists and plant pathologists. These men are studying a long list of chemicals that may yield something of promise. They are finding out what it is that does the work in some of the materials that we have been using rather blindly, and on the basis of that knowledge they will go ahead to devise better materials. The progress that they have made in the last four or five years is actually, I believe, more than was made in all of the history of such work up to that time.

In the State experiment stations the same is true. Their work in total covers a very wide field and their progress is certain to mean much in the discovery of better sprays. In several of our progressive stations the actual program under way today is so far in advance of what was in progress 10 years ago that there is no comparison between the two.

On top of this a considerable number of manufacturers and producers have undertaken extensive studies for the development of better means of fighting pests. Manifestly, the increased size and extent of the market for improved materials is the principal factor behind this movement. That is as it should be. If the market were not there the manufacturer would not be justified in spending research money. But it is interesting to observe that the widened market has already brought about marked advance in pioneering by manufacturers and has resulted in a determination by a number of them to devote such sums as may be necessary to thorough investigational work on which to base new and improved materials.

Some concrete results from all this are already in evidence.

Ten years ago we had only very crude and ineffective ways of combating some of our common household insects. Those campaigns to "swat the flies," for example, may have awakened popular response because of our general feeling of irritation toward the troublesome offenders, but they never could result in anything remarkable as a control measure. Today, we have an effective and simple means of fighting flies and various other pests in our houses.

For generations growers of cereal crops in our mid-western States have suffered severe losses from certain cereal diseases that are carried over from year to year on the seed. Within a short time new, simple, and effective chemical treatments have been devised by which these diseases can be tremendously reduced.

A few months ago the Mediterranean fruit fly made its first appearance in this country and unluckily was found to be established over a relatively large area. With our awakened understanding of the seriousness of this pest, and utilizing resources that have been developed recently, we have jumped in and fought that insect to a standstill. Five years ago I doubt if any such favorable outcome could have been hoped for.

#### Materials of Greater Effectiveness Now Under Way

**A ND FOR** every item that has already reached "the stage of accomplishment, there are a dozen that are on the way. They will make themselves known as time goes on. For example, we need sprays that will positively control certain apple diseases, even under conditions of severe infection. Research studies that are in progress are pretty sure to give us, presently, some notable advances in that direction. We need contact sprays that will kill some troublesome insects that we cannot now control by spraying. There is good prospect that we shall arrive at materials that will meet that need. We ought to be able to attack insects that spend part of the year in the ground and kill them before they come out and invade our trees. Work is under way that gives promise in that direction.

#### Closer Co-operation Between Investigator and Manufacturer

**J**IN A GREAT DEAL of this there is today a new kind of co-operation between the responsible manufacturer on the one hand and experiment station workers on the other. In this co-operation the Crop Protection Institute is taking part. Indeed, it was organized largely for that purpose, and its activities, which are constantly growing, are substantially drawing these two fundamental agencies together in a proper and helpful way.

It is manifest that the experiment station staffs constitute a great body of scientific knowledge and enterprise, working for the welfare of American horticulture and agriculture. It is also manifest that spray materials, dusts, or fumigating materials, like any other commodity, represent manufactured articles which must be promoted and maintained by business organizations. Fundamentally the two agencies, namely, the scientific workers in the stations and responsible manufacturers, share the same field. They ought to share the same ideals. If they are going some day to do that, there must be some common ground of approach, some proper means by which they may discuss problems together.

The function of the Crop Protection (To Page 32)

# The PLACE of "STATION SCHEDULES"

**K**NOWLEDGE AND PRACTICE go hand in hand in building up the spray and dust schedules. All the workable information of the horticulturist, entomologist, and pathologist is being used by the better growers. Practices in some sections may differ from those in others. This does not necessarily mean, however, that the growers of one region are better informed than those in another. The differences are generally due to environmental and market conditions.

The element of chance plays such an important role that under some conditions and during some years the spraying and dusting practices of a rather poorly informed grower may actually prove to be more profitable than similar practices of a better trained grower. The most capable producers cannot always be certain that their spraying and dusting operations are the last word and the best possible.

Our fund of horticultural information is constantly changing. What is true today regarding insects, diseases, spraying and dusting may not be true next year or the following year. Every year brings contributions of the agricultural experiment stations and the manufacturers of spraying and dusting machinery and chemicals. Since this is true, the more progressive and forward-looking growers recheck their methods and practices and in some instances make at least slight adjustments and changes in spraying and dusting materials and schedules almost every year.

#### Importance of Spraying and Dusting

**S**PRAYING and dusting are the most important orchard practices. They are the cheapest insurance against failure. The cost is so small when compared with the returns which the control practices will bring that the orchardist can well afford to give the operations major consideration. The fruit grower who fails to spray or dust thoroughly, properly, and at the right time will not succeed; even though he may use the best known cultural practices, pruning methods, and fertilization systems.

The various sprays and dusts are applied to fruit trees and plants to prevent damage from the insects and fungous diseases injurious to orchards, vineyards, and small fruit plantations. For practical purposes, all the fungous diseases and insect pests may be grouped under the following three heads: (1) fungous diseases, (2) biting and chewing insects, and (3) sucking insects.

The fungous diseases are controlled by spraying or dusting the fruit trees and fruit plants with such mixtures as lime-sulphur and Bordeaux. Some of the most common diseases of fruits requiring treatment for their control are apple blotch, peach leaf curl, black rot of grapes, and brown rot of the stone fruits.

#### Prevent Disease and Insect Injury

**T**HE FRUIT GROWER should keep in mind the fact that the fungicidal sprays, such as lime-sulphur and Bordeaux, prevent the diseases instead of curing the plants of them. It is highly important, therefore, that the sprays

*The Spray and Dust Schedules Issued by Experiment Stations Are of Value as General Guides Which Experienced Growers Will Modify to Meet Conditions as They Exist in Their Fruit Plantations.*

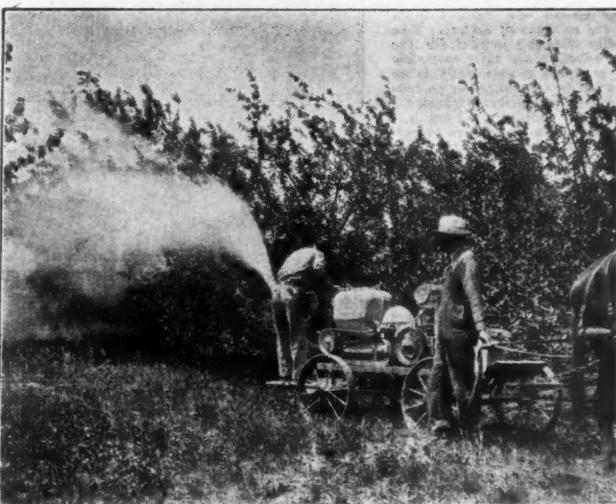
By J. J. TALBERT

University of Missouri

be applied at the right time, to prevent the spores or so-called "seeds" of the fungus from germinating and growing. Fungous diseases are spread by such agencies as the wind and rain. Once such growth or infection is



Above, a small power spray outfit. Below, a small power dusting outfit, both suitable for orchards of moderate size.



started in the leaf or fruit, the sprays are useless because they do not penetrate the surface of the plant tissues.

A protective spray or dust applied as a covering on the susceptible parts kills the fungous spores alighting on the coating before they have an opportunity to cause infection. In all spraying or dusting operations, it is important that all susceptible parts of the plant be kept thoroughly covered and that the new growth be covered often enough to prevent the germination of fungous spores and later injury.

The most important essentials in spraying or dusting are thoroughness, timeliness, and the use of the proper mixture. The application may be applied at the right time, in the right way and with the right materials, but if it does not entirely cover the parts of the plant needing protection against the ravages of diseases and insects, it is not likely to be of value in preventing injury.

#### Every Orchard a Different Problem

**N**O TWO ORCHARDS are alike in regard to the occurrence or the severity of attacks of the common injurious diseases and insects. Where the grower, therefore, has sprayed or dusted his orchard properly for a number of years and knows the insects and diseases that are present, he may be able to change or vary the applications, making the intervals between them longer or shorter as required. He may also change the kinds and proportions of chemicals. If he knows his conditions and has studied his problems carefully, the alterations made may be beneficial and at the same time less expensive.

The directions and discussions given in spraying and dusting schedules are primarily for the beginner. Moreover, it is generally assumed that all the pests requiring control by spraying and dusting are present and need applications directed against them. Great effort and pains are taken to be as specific, clear, and exact as possible. The beginner must realize, however, that some thought, effort, and time must be devoted to the problem of spraying and dusting fruits in order to understand suggestions and recommendations. If it is understood that the trained and experienced grower who knows his orchard and conditions may be able to vary or change his schedules to meet and handle problems peculiar to his orchard, greater progress is likely to be made.

#### Underlying Spraying Principles

**A**GREAT FUND of scientific information dealing directly with spraying and dusting has been built up by the plant pathologist, entomologist, chemist, horticulturist, engineer, and the grower himself. The plant pathologist and entomologist, through a knowledge of the life histories and habits of the most important diseases and insects, have pointed out and made clear the most generally accepted control measures. The chemist has endeavored to find and develop in the laboratory chemicals which will destroy biting and chewing insects, burn and suffocate those that suck plant juices, repel both types, and give the (To Page 33)

# OIL SPRAYS in the EAST

*The Use of Oil Sprays in the East Has Increased Tremendously in the Past Ten Years, Mainly Because of the Prevalence of the Red Mite. Growers Are Relying Mainly on Commercial Oils of Standing.*

By PHILIP GARMAN

Connecticut Agricultural Experiment Station

#### Desirable Qualities for an Oil Spray

**D**URING the last few years, however, we have also advanced in our ideas concerning desirable qualities for an oil spray. For instance, an oil stock should (1) mix readily with cold and hard waters; (2) should withstand freezing; (3) should have good killing power for the insects for which it is applied; (4) should be non-injurious to trees and operator; (5) should mix with fungicides such as lime-sulphur or Bordeaux mixture; and (6) should be so standardized that uniformly good results may be obtained from year to year.

These points apply to commercial oils as well as home-made products, but some of the points, though

highly desirable, are not absolutely necessary in an oil spray. Let us consider the points in order.

Miscibility applies to both emulsions—commercial and home-made—as well as miscible oils. If the oil does not mix, it does not go on the tree in emulsified form, which is the equivalent of spraying with pure oil. If it does not mix readily, there is loss of time, and time is money.

Non-freezing qualities apply in the North, but not necessarily in the South or for emulsions that are used shortly after making.

That it should have good killing power goes without saying for any insecticide. By "good" I mean not less than 90 per cent kill for the insects treated, provided, of course, good coverage is obtained.

That it should be non-injurious to the trees also goes without saying. Unfortunately, some products have been placed prematurely on the market with disastrous results. Continuing—the work of the spray man is hard enough without adding a shower-bath of vile smelling and injurious compounds, and if they can be avoided, there is no one who would not willingly do so.

Considering the fifth requisite, there is a growing belief, though not yet supported by much experimental

**T**HE HISTORY of oil sprays in the East dates from the attempts to control the San Jose scale. At this time the oil business was apparently not highly specialized nor were the services of experts as readily available as they are today. Consequently, oils said to be the same in emulsifying properties frequently proved to be quite different though showing similar features as judged by oil standards in use. The development of the automobile has very greatly increased the output of lubricating oils, the various fractions and grades being more and more circumscribed by chemical and physical tests. As a result, oils available today are much more likely to possess constant emulsifying properties than those of several decades ago.

In the last 10 years, the spray oil business has been revived, largely because of the agitation among growers for better control of San Jose scale. In the East, a very great impetus has been given the movement by the increase of the European red mite and the possibility of its control with oil sprays. Third, fourth and fifth reasons for the revival of oils lie in the relative cheapness of the newer products, their ease of handling, and kindness to the operator.

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data, that there should be a fungicide present in dormant sprays. This means the addition of a stabilizer in the form of glue or some other material so that an emulsion will not break when so combined. Many of the newer products meet this requirement and are being used in the East today.

The last and probably the most important requisite or desirable quality lies in standardization, which has been so hard to obtain until recently. Even now many oil preparations vary in properties, though there are many that have conquered this phase of the question sufficiently to find a market in the East.

As already remarked, few oil sprays combine all of the desirable properties; hence, it is important to note (1) that oil content of the stock influences freezing; (2) that the emulsifier influences stability and indirectly the safety to the trees; it also influences compatibility with fungicides; (3) that degree of oil sulfonation influences safety, particularly for summer oils; (4) that viscosity of the oil used influences ease of handling—the heavier the oil, the more difficult to manipulate. It also influences killing power for some insects.

#### Selecting the Proper Oil

**G**HE READER will readily perceive that selection of the best oil, either emulsion or miscible oil, is not easy in spite of what is known of the various physical properties. Probably the simplest means of consideration in selection will be on a basis of cost, safety, toxicity, reliability, and compatibility as outlined. Thus, if costs are the same per 100 gallons or per 100 equal-sized trees covered, then safety, toxicity and so forth need to be compared. If cost and safety are the same, then toxicity, reliability, and so forth, or if the first three are the same, then reliability and compatibility should be the deciding factors. An oil may be graded or scored in the different points. Say we have three oils, A, B, and C. Then according to our plan, we would have the following:

Oil	Cost	Safety	Toxicity	Relia-		Final
				bility	bility	
A	1	1	2	1	1	6
B	1	1	1	1	2	6
C	2	1	2	1	1	7

It is very plain that oils A or B are equally good

and the actual choice may be left to personal preference. Perhaps the grower will not need a fungicide, in which case the selection of oil B would result. Some of these points, however, are not easily determined. For example, should there be aphid, red mite, scale, and leaf roller, it will be very difficult with any experimental data now at hand to distinguish between commercial oils. This information is slow to accumulate and the work cannot be accomplished in one year. It would therefore seem advisable for the manufacturer himself to test his products thoroughly before marketing, and the business of government and State experiment stations to check the experiments wherever possible.

#### Use of Oils in the East

**E**ASTERNA fruit growers are notably conservative in the use of oils. They are cautious, place a high value on their trees, and as a rule are not willing to experiment with new products unless there is a considerable saving from their use. At the same time, they expect good killing properties and are willing to take necessary precautions to be rid of the (To Page 31)

# The MARGIN of SAFETY

*In Order to Increase the Proportion of Fancy Fruit the Grower Must Apply Reliable Sprays and Dusts Intelligently. The Equipment Must Be Adequate to Allow a "Margin of Safety" for All Emergencies.*

By O. G. ANDERSON

Purdue University

**S**earching analysis comes to every successful business at least once each year. Leading fruit growers are now taking inventory of the strong and weak points in their enterprise. The relatively lower percentage of clean fruit in the last harvest is a matter of much concern with more than the usual number of growers. With some growers, unusual weather was the cause. With others, the reduced percentage of clean fruit has been cumulative for a number of years.

The best grades of fruit are being sought for more earnestly by growers than ever before. When the proportion of extra fancy and fancy fruit is high, it is because the grower has applied reliable spray mixtures most intelligently, and with adequate equipment. Intelligent application includes the flexible sort of spray schedule in which the number of sprays and their time of application may be shifted slightly to meet weather conditions. The accurate timing of applications year after year depends upon the use of equipment adequate enough to allow a grower a margin of safety for seasonal variations and other emergencies.

When an inexperienced grower buys an apple orchard 12 years old, something of this sort happens: His first problem is to purchase spray equipment. He selects two 12-gallon outfits from catalog specifications. On paper he estimates that he can use two guns on each outfit and spray his orchard in three days. What is wrong with his plan?

In the first place, if he were an experienced grower he would not expect a 12-gallon field delivery from the outfit even the first year. As time passes, pump performance may drop 20 to 40 per cent, while gun delivery may increase due to wear. In four years the increase in tree area overburdens the spray machines. The grower is unable to cover the orchard thoroughly within the allotted time of three days. Since he was underequipped at the start, the continuous overload has increased the normal wear on the machines.

It is now necessary for him to trade in the sprayers or buy a third machine and train a new crew in order to obtain coverage within the time limits.

The additional labor is expensive and difficult to get, so he will probably trade the two sprayers, or at least one of them, for a larger outfit. What appeared to be shrewd buying four years ago turns out to be something else.

Though among the most abused of farm implements, a spray outfit has an average life of five years, and many last twice as long. But the loss this grower has taken on an early trade-in is small compared with the loss he has already suffered in blemished fruit because of inadequate protection. So his biggest mistake was his failure to make the trade sooner!

#### The Changing Requirements for Labor and Machinery

**E**VEN experienced growers find it difficult to state specifications for sprayers to be used for the next six years. What will be expected of labor six years hence? Will their specifications provide a margin of safety for the spraying problems of 1935? And yet a sprayer receiving good care will not be worn out at that time!

Contrast for a moment the single disk nozzle and bamboo

rod of 12 years ago with the quadruple nozzle and double gun of today. A 12-gallon pump and 225 pounds pressure were highly efficient then. Today we have pumps more than three times as large. Pressures range to 400 and 500 pounds. Engines and tanks are not only larger, but the margin of safety in the whole outfit is more adequate. The business world views the present efficiency of labor in these terms—not how long will the present machinery last, but how soon can it be replaced profitably?

To an extent commensurate with the size of the business, a fruit grower is guided by the same principles as the business man. In no other branch of agri-

culture is profitable production so dependent on efficient and adequate machinery and labor. The success of a year's business may hinge upon the completion of a spray application in three days.

#### The Peak Load for Spray Machinery

**J**N SOME fruit sections the experiment stations advise complete coverage of the orchard in three days for the control of scab. In other sections or in other years a longer period, not to exceed five days, may give control when blossom buds start to expand. Every successful fruit grower knows that the amount of spraying equipment he must own is determined by this critical period in early spring. He prepares in mid-winter by overhauling every machine and by stocking the repair parts which experience has taught him to keep on hand. If his spray pumps carry an adequate reserve of two to four gallons above nozzle requirements, it may be a sufficient margin of safety for this grower.

However, the margin of safety suited to some fruit growers will not meet the problems of others. In the suggestions which follow, an attempt is made to present methods which growers are using or considering as a margin of safety for their fruit during the 1930 campaign.

#### Methods of Insuring a Margin of Safety

**J**N THE FIRST place, a greater number of growers will consider buying larger outfits in exchange for present equipment. This will be after they have exhausted all methods of accomplishing the job with the old outfits.

Others who cover their orchards within the time limit may find twice as many wormy apples in the middle third as in the lower third of the tree, and eleven times as many worms in the upper third. Where their spraying has been done from the ground they are installing towers to spray the upper portions of tall trees for more effective control of worms and scab.

Where the gun or the rod is used from the ground, the coverage is likely to be unsatisfactory when trees are more than 22 feet high. With the largest gun disks, coupled with plenty of pump capacity and pressure, spraying from the ground may be effective at heights of 25 to 28 feet, but even the wind may affect results considerably.

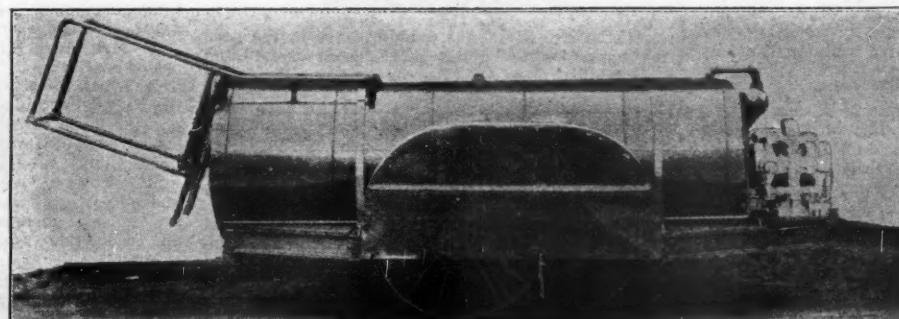
When spray outfits still have many hours of service left, but more capacity is needed, new parts may be obtained for the pump which will increase the capacity two to four gallons a minute. If the engine has sufficient power to carry the extra load, this is an economical method of increasing sprayer efficiency.

When the water supply is a quarter mile away, one-half of the day is spent in refilling. What is needed here, of course, is an extra team and a low priced driver so that only five to 10 minutes are spent in refilling. The labor and operating cost of spraying outfits may vary from \$20 to \$35 a day and keeping them at work only half the time is most inefficient. When 300-gallon tanks on the sprayer can be moved readily in the orchard, the output of the sprayer is stepped up still more.

In some instances the problem of water supply has been solved by a large reservoir with numerous mixing stations throughout the (To Page 30)



In large plantings the tractor is an almost indispensable adjunct in spraying. Above, hauling a 300-gallon outfit at intermediate speed and getting thorough coverage. Below, a mammoth portable outfit with 400, 500 or 600 gallon tank, dual wheels and 30 to 35-gallon pump operated from tractor power take-off. The output per day exceeds that of any other portable machine. It is filled from portable tanks.



# It All Depends on the GROWER

**O**WNERS of horticultural crops need to put into practice the findings of the older experiments that have proved their worth and leave many of the new trials for further aging in the proving grounds of the experimental stations. Watch any audience of orchard operators during a State meeting, when investigators are telling of new materials or new formulas. Half of the audience will be writing notes, and how eagerly they question the speaker for the name of a new product. In contrast, how few notes are taken by these growers at a county meeting, when a field worker is laying down the basic and well established requirements that will bring a crop through to perfection.

Nine times out of ten the spraying success of a neighbor is due to his painstaking interpretation of old time facts, coupled mainly, with his will power in putting necessities into practice. Less successful competitive neighbors never approach adequate spray success because they are unwilling, for the most part, to acknowledge that there is anything vitally wrong with their methods, and hence, they are incessantly inquiring for a better material to solve their problems.

The writer is firmly convinced that the best known and most effective spray material wrongly timed and poorly applied, as so often happens, is not worth half so much as a mediocre or milder material, of half the killing power, when the latter is perfectly timed and thoroughly applied. Let me ask every sprayman, reading this article, why it is that scores of operators in North America are getting adequate, economical spray protection using dust, half or third strength dilutions of liquid or dry lime-sulphur, or unbelievably weak strengths of Bordeaux mixture.

There is only one answer that I know of, and that is this—a material of known and adequate performance, correctly and frequently timed and thoroughly applied can never fail to give protection.

#### There Is Only One Way

**I**F YOU WERE to read all of the world's literature on spraying methods, materials and dilutions, there would be only one guaranteed schedule that you could place in anyone's hands for the prevention of 1930's preventable pests. Here is the long established secret, and yet the newest thing in pest control. *Follow your State schedule and the starting announcements of your spray service for each disease and insect of importance to your locality, then never allow more than 10 days to pass without another application.* If the equivalent of one day of rain has fallen since the last application, then shorten that period to seven days, so

*The Most Effective Material, Wrongly Timed or Poorly Applied, Is Not Worth Half as Much as Material of Half the Killing Power When the Latter Is Correctly Timed and Thoroughly Applied.*

By H. A. CARDINELL

Michigan State College

long as that pest is in the zone where it can do damage. Perhaps you have already thought to yourself, how could I afford to spray so many times for fruits or vegetables at the price that has prevailed since the last world war? No advisor can answer for you.

For the season of 1930, every producer of a horticul-

tural crop requiring spray protection must place himself in one of the following classes. Every orchardist has already been in one of these groups, so the classification will not be surprising.

#### Classify Yourself as Regards Spraying Practices

**G**Roup 1. Will you in 1930 spray once or twice but not to exceed three times? There is economic justification for this group, with a home-use planting, playing second to tenth fiddle on a general or specialized farm of other than horticultural crops.

Group 2. Will you spray three to five times? The producers of 75 per cent of the market crop of North America have for the past decade or more associated themselves with this group. With the present system of sites, soils and management, that many will, undoubtedly, be in this group for at least another decade.

Group 3. Will you start the 1930 spraying as though every plant was of the most susceptible variety and as though you would harvest the best yield and receive prices the average of those for the light crop-years; in other words, will you start spraying at the earliest need, treat early and most susceptible varieties first, and spray every 10 days, if it is dry, for as long as your State schedule indicates that diseases and insects are a menace? Shorten this program only after three months, when crop failure is certain.

#### Why and How of Classification Three

**T**HE ECONOMIC interest for the number three group is to be found in the chemical investigations of Thatcher and Streeter of Cornell University. They conclude in their 1925 Technical Bulletin 116, "that from 89 to 94 per cent of the sulphur applied as dust (1925 type) was lost from the foliage during the first week; while the losses of sulphur derived from lime-sulphur spray without Kayso varied from 45- to 75 per cent." Group three growers are not willing to trust a crop of good varieties to a group two schedule.

Can a specialized grower spray (using very light dosage—one-third to one-half of usual deposit) a crop of apples 10 to 15 times and net a profit? If he cannot, something is decidedly wrong with his varieties, site and management. If something is wrong with these three big factors, the orchard will remain as group two, as far as spray protection is concerned, especially during light or off crop years.

For the majority of diseases and (To Page 29)



Above. The latest modern equipment. No condition of soil or weather can interfere with its successful operation. If it is windy or rainy in the day time, lights are available on tractor and sprayer for night work. A carbide cake generator is used for the lights, supplemented by a tank of carbide gas in case the generator should fail. This also acts as a reserve, since tractor headlight is from a tank of gas. With adequate power, the spray is completely applied, giving full coverage to the trees.

Left. An illustration of the effect of a high wind, preventing the dust from reaching the tops of the trees. The same condition arises in the application of liquid sprays in high winds.



Right. For low growing crops and for "spot dusting" the knapsack outfit is invaluable.

# EXTERMINATING the "MEDFLY"

This "Most Destructive Insect Pest in the World" Attacks Everything Except Golf Balls, It Is Said, But in Five Months It Was Apparently Eradicated.

By J. J. DAVIS

Purdue University

tigators, the committee was unanimous as to the need of the work, the effectiveness of the work to date and the desirability of attempting complete eradication of the insect.

#### Eradication Program Effective

**W**ITH THE discovery of this much dreaded pest in Florida in April, 1929, and with an adequate available fund for work, immediate action was taken to do everything possible to eradicate the insect. That the eradication program has been successful even beyond expectations is evident from the statement in the committee's report as follows: "From an infestation where hundreds of flies could be obtained with a few sweeps with a net and where infested fruit was common, to a point where all methods of trapping fail to catch a single fly and where no fruit infestation can be located

in spite of diligent and extensive search, is little less than marvelous. Weather conditions may have assisted in reducing the infestation, but a study of all data clearly shows that the complete destruction of fruits in infested zones and the thorough use of poison sprays have been largely responsible."

Few new insect problems can have the distinction of being recognized as problems of eradication. The Japanese beetle, the European corn borer, the San Jose scale and many others are problems of control, but not of eradication. The fact that the citrus growers of Florida are co-operating in an effort to eradicate, that the area is within one State and that there are comparatively few highways to be guarded, that a host-free period may be formulated and that a large fund was immediately available for the work when the pest was first discovered, together with the fact that fearless and energetic officials were in charge of the program, are sufficient reasons for recognizing the fruit fly fight an eradication program rather than simply one of control.

#### Description of Insect

**T**HE MEDITERRANEAN fruit fly is a small brown, yellow and black mottled fly not larger than a house fly. It belongs to the family (To Page 28)

**W**HEN AN INSECT is heralded as the most destructive fruit pest in the world, as has been the Mediterranean fruit fly, the entire horticultural industry becomes immediately interested; and, well they should be even though there is little likelihood of its destructiveness extending to the northern States. Therefore, the fruit growers of Ohio, Indiana, Kentucky, Illinois and other northern States are intensely interested in this fruit fly problem and its effect on the fruit industry of the southern States.

#### Fruit Fly Problem Studied

**T**HE WRITER was privileged to be a member of a committee delegated by Secretary of Agriculture Hyde to study the fruit fly problem in Florida and to make recommendations. Other members of this committee included a prominent commercial fruit grower, W. C. Reed, of Vincennes, Ind.; Dr. W. O. Thompson, president emeritus of Ohio State University; Prof. W. P. Flint, chief entomologist of the Illinois Natural History Survey and Dr. W. H. Alderman, chief in horticulture of the Minnesota Agricultural Experiment Station.

After spending seven days in Florida studying the problem and interviewing citizens, growers and inves-

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it is bu  
finest

# FOR THIS SEASON'S SPRAY JOBS



## S P E C I F Y

# "HY-PRESSURE" HOSE

FOR line-system spraying or for field rigs you can't get a better spray hose than Goodyear "Hy-Pres-  
sure." It holds pressures required easily and safely.  
"Hy-Pressure" is made with a tough outside rubber  
hide—to resist severe abrasive conditions. Inside  
it is built with three double braids of finest cotton cord riveted in rubber.

*Goodyear Wingfoot Spray Hose, in 3/8" and 1/2" sizes,*

*is a capable spray hose for average pressures.*

It is impervious to all solutions used in spraying service. Goodyear devised a special manufacturing process to make this the sturdiest and most durable spray hose for orchard use. You will save money by specifying Goodyear "Hy-Pressure" Spray Hose throughout for

1930 spray equipment. In 3/8", 1/2" and 3/4" sizes; in lengths to 500 feet.

**G O O D Y E A R**  
S P R A Y H O S E

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# CUTTING a SMALL LOSS in TWO

**T**HE FARM we own and operate contains 40 acres, all in fruit. Another adjoining "forty" which we rent, has 20 acres in orchards. Of this 60 acres, 35 are in apples. The leading varieties are Jonathan, McIntosh, Spy, Hubbardston, and Wealthy, with smaller plantings of Wagener, Baldwin, and Grimes. Then there is one old block containing a few each of Greening, Tolman, Russet, King, etc., a typical old Michigan orchard as formerly planted. The ages of our 1200 trees range from two to 60 years. Some are just beginning to bear, and a sizable portion is too young to cut much figure in production.

It is manifestly impossible under such conditions to take any spray schedule or calendar and apply it generally to the orchards. The variation in periods of bloom, in the rate of tree development and in susceptibility to infestation, infection and spray injury demand a course of treatment best adapted to each variety. A successful grower must know his trees and in the light of that knowledge adapt such general treatments as spray schedules to the needs of his individual orchard, for best results.

#### Spray Program Adapted to Conditions

**M**Y FIRST JOB, in late winter, is to see that my spray outfit is in the best possible condition for the work ahead. I have a 200-gallon outfit with a capacity of 12 gallons a minute under pressure of about 200 pounds. For eight years I used oil emulsion, three per cent actual oil, but two years ago I changed to miscible oil, with better results. For four years I have added three pounds of soluble sulphur to each 50 gallons of oil spray and believe this makes an ideal delayed dormant spray. At any rate, I have found scab more easy to control since adding the sulphur to the dormant operation.

Up to last year (the past season) I used lime-sulphur for the pre-pink, pink and calyx sprays, one part lime-sulphur to 49 of water. Stronger lime-sulphur solutions, I found, created a russetting problem that offset the gain in control.

For the balance of the season I used commercial prepared dry-mix, with the addition of five pounds lead arsenate to each 200-gallon tank. The application of these sprays depends upon weather conditions. If the season is wet, we plan to keep all new growth as nearly completely covered as possible until well into July, with a final application early in August.

#### Thorough Coverage Essential to Successful Spraying

**P**REVIOUS to the past season, I used the spray gun throughout the season, but this last season we used the new Bean four-nozzle, six-foot rod. With this I used more material than with the gun, but was able to put the material where I wanted it, as a spray, which is highly important, especially for the calyx

*For Ten Years This Grower Has Kept His Loss from Insect and Disease Injury Down to About Ten Per Cent of His Apple Crop. In the Season of 1929, He Was Able to Still Further Reduce This Loss to Five Per Cent, in a Season of Exceptional Scab Infection.*

By W. S. HAWLEY

Pleasant Valley Fruit Farm, Michigan

spray. This rod is a little harder to handle than the gun, and for the later applications I still prefer the gun.

I always spray with the wind, covering as large a portion of the trees as possible, and spraying again as soon as the wind changes, as I am convinced that thorough coverage is the most important essential of successful spraying; more important than more powerful materials.

With this practice I have, during the past 10 years, been able to keep the percentage of culls and unmarketable fruit caused by insect and disease damage, down to 10 per cent of the crop.

#### Iron Sulphate Spray Reduces Number of Culls One-Half

**L**AST YEAR the Michigan State College recommended the Dutton formula for lime-sulphur; the



Effective publicity is not always expensive. The attractive permanent sign above, on the main north and south highway of Western Michigan (U. S. 31) brings many tourists to the Pleasant Valley Fruit Farm. Below. A window display in one of Ludington's largest stores, a most effective bit of publicity during the resort season.

1-40 formula with the addition of one and one-half pounds iron sulphate to each 100 gallons of lime-sulphur dilution. With this stronger spray in the pre-pink, pink and calyx sprays, together with the use of the four-nozzle rod, I find our percentage of culls for the



past season has been cut in two, to less than five per cent of the total apple crop, and with no spray injury whatever. The season was one of the worst in point of general prevalence of scab, and the only change I made in my operations was, as stated, the use of the Dutton formula with the four-nozzle rod. The rod, I believe, gave better coverage, but I am confident it was the Dutton formula that cut the loss in two. The appearance of the foliage was also improved as to size and depth of color.

We have never been bothered with spray residue as we usually have enough rainfall after the last spray application to wash the spray from the ripening fruit.

#### System of Fertilizing Changes Bearing Habits of Trees

**A**S PREVIOUSLY STATED, many of our trees are young, and, as our soil is quite heavy and rich, the fertilizing of these trees has been an easy matter. I have had, however, an interesting experience with some of the old trees, in the 60-year-old orchard. We followed this plan: In the year they would ordinarily bear their regular crop we applied a good coat of barnyard manure with the addition of three pounds of ammonium sulphate around each tree. The following year we applied the three pounds of ammonium sulphate alone, in both cases applying the fertilizer just before plowing in the spring, before growth started.

As a result of this practice, together with proper pruning of the trees and thinning of the crop, we have changed the trees from biennial to annual bearers, and have harvested five consecutive annual crops. Though not bumper crops, they were highly profitable.

#### Spraying Costs and Marketing

**T**HE COST? In 1929 the cost for spray material in all operations was about \$225, about \$147 of which, as nearly as I can estimate, was for spraying apples. Altogether I spray 500 pear trees, 350 bearing cherry trees, 800 bearing peach trees and the 1200 apple trees of all ages.

We harvested 600 bushels of pears, 1100 of peaches, 2300 of salable apples and five tons of cherries.

We sell most of our fruit at retail, at the farm. Although we are off the main traveled highway, we have succeeded in bringing our customers to our door. Last season over 3000 retail buyers came to our farm, most of them with their own baskets or other packages, thus cutting down on our sales and package expense. We advertise. Newspapers, the "movies," and even the radio, tell our story, at a price. A window display in the largest retail store, without cost to us, brought many new customers, while a large sign on the main highway directs many to our door. By careful attention to each sale, however small, we manage to hold most of our customers from year to year. Satisfied customers are assets.

# CONTROL of PEACH BACTERIAL SPOT

By JOHN W. ROBERTS,  
LESLIE PIERCE and  
JOHN C. DUNEGAN

United States Bureau of Plant Industry

**B**ACTERIAL SPOT of the peach caused by *Bacterium pruni* has been known to plant pathologists for about 20 years, but only within the last 10 to 12 years has it become seriously destructive to the peach over extensive areas. It occurs in practically all peach sections of the eastern United States, but causes serious annual losses chiefly in sections in which the soils are light and comparatively low in fertility.

For many years it has been noted that vigorous trees in fertile soil are less susceptible to the disease than those in light soil or in a state of neglect. Therefore, proper pruning, cultivation, fertilization, and other good orchard practices are recommended as control measures. Experiments have shown these are not always dependable as the sole means of control in sections where bacterial spot is severe and especially where soil improvement is difficult. Attempts to obtain control by removing sources of infection have not been successful as yet.

#### Zinc-Lime Sprays Developed

**I**N VIEW of these facts, it seemed desirable to develop, if possible, a spray that would help to control the disease. In the years 1925-29, about 200

different sprays were tested in Indiana and Arkansas in co-operation with the agricultural experiment stations of those States. Most of them were soon discarded because they either showed no evidence of control or were injurious to the peach. At the close of the 1927 season, it was evident that certain sprays containing zinc as the essential ingredient were the most promising, as they had, through three seasons, shown signs of controlling the disease and had caused no apparent injury. It was also evident that the two to three applications used in 1925, 1926, and 1927 were insufficient.

In 1928 and 1929 tests of these sprays, hereafter called the zinc-lime sprays, in southern Indiana and in Arkansas showed that six applications at intervals of two weeks beginning at petal-fall would greatly decrease the number of infections on foliage and on fruit. In addition, there was a stimulation resulting in larger and darker green leaves. There was considerably less

defoliation and the number of fruits severely injured by the disease was considerably lessened. No spray injury was noted even with sprays containing twice the amount of zinc sulphate here recommended. When arsenate of lead was used with the sprays, no more injury was present than when arsenate of lead was used with the ordinary sulphur sprays.

#### Conclusions Concerning the Zinc-Lime Sprays

**I**N THE CONTROL of peach bacterial spot, the zinc-lime sprays show promise, for the following reasons:

1. In the experimental trials they have checked the development of peach bacterial spot.
2. They have not injured fruit, foliage, or any part of the tree, and they can be combined with arsenate of lead without greater risk of injury than is usual with sprays containing arsenate of lead.
3. They have stimulated leaf development and possibly fruit development.
4. It is possible that the formation of new cankers may be prevented, and this, combined with the control of the disease on fruits and leaves and with the stimulation above mentioned, may cause the beneficial effects of the spraying to be cumulative, i. e., the sprays may

gradually from year to year lessen infection sources and increase the resistance of the trees.

5. The ingredients are cheap and easily obtained.

On the other hand, further experimentation is necessary before the sprays are recommended, without qualification, for the control of bacterial spot. Results in the control of scab and brown-rot with these materials have not been definite enough to warrant conclusions.

#### The Control of Peach Bacterial Spot

RECOMMENDATIONS for the control of peach bacterial spot are as follows:

1. Keep the orchard in a high state of vigor through good cultural practices, i. e., pruning, fertilization, cultivation, cover crops, control of borers, etc. Unless this is done, good results cannot be expected from spraying.

2. For those who wish to try spraying, the following is recommended:

(a) Apply one of the zinc-lime sprays at two-week intervals beginning at petal-fall.

(b) Five to seven applications will probably be necessary.

(c) Take care to cover the fruit and under side of leaves. In applying the zinc-lime sprays it is necessary to use angle nozzles with small openings, moderately high pressure, at least 200 pounds, and to direct the spray upward in order that the under surface of the leaves may be thoroughly covered. The covering of the under surface of a high percentage of the leaves may be accomplished by spraying from the center outward to the tips of the limbs. Remember that all young parts developing during the season, including fruit, leaves, and twigs, may be infected and should be covered.

(d) Arsenate of lead may be used with the zinc sprays.

(e) Do not depend upon the zinc-lime sprays to control scab and brown-rot.

#### The Zinc-Lime Sprays

TWO ZINC-LIME sprays have been developed, the formulas of which are as follows:

- |     |                         |           |
|-----|-------------------------|-----------|
| (1) | Zinc sulphate .....     | 4 lbs.    |
|     | Hydrated lime .....     | 4 lbs.    |
|     | Water .....             | .50 gals. |
| (2) | Zinc sulphate .....     | 4 lbs.    |
|     | Hydrated lime .....     | 4 lbs.    |
|     | Aluminum sulphate ..... | 1 lb.     |
|     | Water .....             | .50 gals. |

Although the spray prepared according to formula (2) stays in suspension longer than that prepared according to formula (1), the latter has given equally as good results. Formula (2) is recommended only when agitation is poor or lacking. The white precipitate settles rather rapidly when there is no agitation, but is easily kept in suspension by agitation.

Zinc sulphate, sometimes called white vitriol, is a common chemical easily obtained through wholesalers and jobbers. If anhydrous zinc sulphate is used, only two and one-quarter pounds are necessary. The hydrated lime should be fresh and of high quality. The grade known as "chemical" is especially recommended. If there is doubt concerning the quality of the lime, additional amounts should be used.

#### Preparation of the Sprays

FILL THE TANK nearly full of water. Start the engine to give agitation. Add the zinc sulphate, which, if the lumps are well broken up, will dissolve in less than five minutes. After it has dissolved, the lime, mixed with a small quantity of water to form a thin paste, should then be washed through the strainer into the tank. If aluminum sulphate is used, it should be added after the zinc sulphate. Finish filling the tank, and agitate for five minutes or more before beginning to spray. Use at once.

#### Why She Enjoyed It

"Did you enjoy the symphony concert?"

"Very much," said Miss Cayenne.

"Did you understand it?"

"No. There is a certain mental relaxation in something that nobody expects you to understand."—*Washington Star*.

*By J. A. McCLINTOCK*  
Tennessee Agricultural Experiment Station

**T**O THE TENNESSEE peach grower the season of 1929 was the worst in the history of the peach industry. There have been seasons when frosts practically wiped out crops, but such seasons were not as disappointing as that just experienced. For when frosts hit the crop, the growers are aware of their loss early in the season, and are spared the expense of labor and money usually required to bring the crop to successful maturity.

#### Brown Rot Takes Heavy Toll

**I**T IS A well-known fact that brown rot readily follows curculio injury. The past season's observations indicate that the openings made by the oriental moth larva are additional avenues for infection by brown rot. Thus, with these two insect pests favoring the brown rot fungous infection, it was not surprising that brown rot took a heavy toll in 1929. Growers reported that much fruit which appeared sound when loaded into iced cars showed a large percentage of brown rot when it reached the markets. Wormy peaches are hard enough to market, but brown rot renders the sale of such peaches

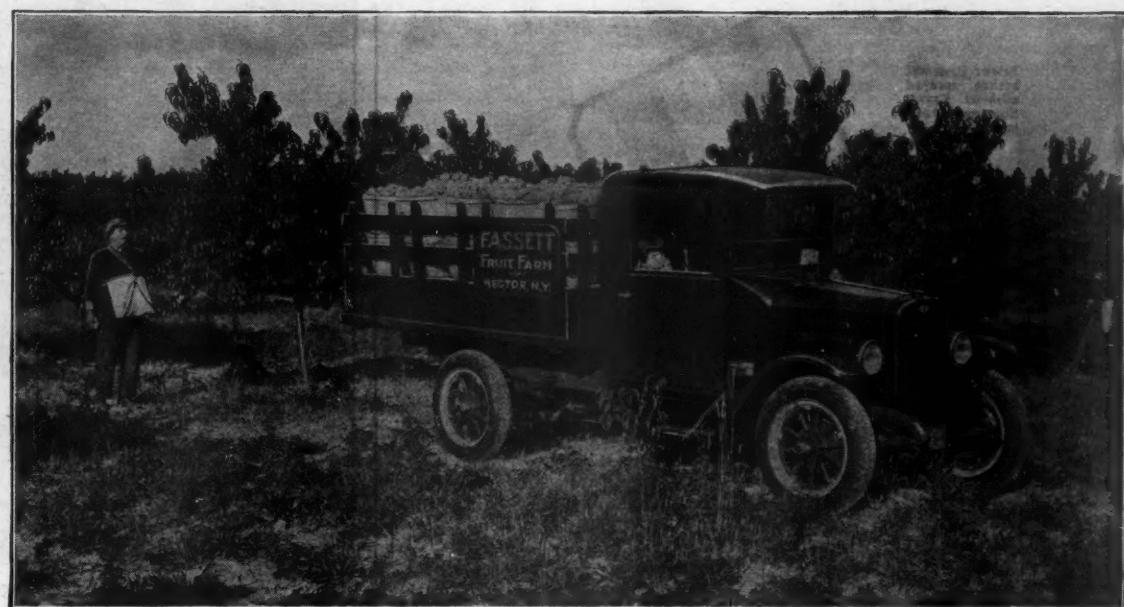
impossible. For these reasons some growers received nothing for carloads of peaches of the 1929 crop.

With such concrete evidence of the destructive possibilities of brown rot, especially when aided by two species of insects making openings for its entrance into the fruit, one is forcibly impressed with the necessity of getting rid of all sources of brown rot infection.

#### Mummies of Trees Main Source of Infection

**I**T IS WELL established that mummies left on the trees (Figure 1) are important factors in overwintering the brown rot fungus. There is a question, however, as to the relative importance of mummies on the ground. A careful check-up in commercial orchards in Tennessee the past year, regarding the degree of spore production from ground mummies, indicated that in a few cases

(To Page 30)



## King of the Country Road

**I**N this great truck and tractor age the success of International Trucks stands like a beacon on the horizon. Coming into prominence like a thoroughbred destined for victory, International Harvester has scored a triumph in truck engineering and in popular approval throughout the world. The basic reason is twofold: International trucks are soundly built on 25 years' experience in automotive manufacture—and International performance is safeguarded by a Company-owned truck service organization without a peer in the industry.

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# INTERNATIONAL TRUCKS

# BETTER METHODS in APPLE SCAB CONTROL

*By G. W. KEITT*

*University of Wisconsin*

SCAB CONTINUES to take a very heavy toll from apple culture. Better methods of control than are now available are much needed, and earnest effort is being made to develop them. In the meanwhile, it is highly important to make the best use of the methods that we have. The experience of the past year affords abundant evidence that many growers are not benefiting from some of the newer knowledge on scab control. In years of mild or moderate scab development, the disease is easy to control; but in epidemic years, the losses, even in well-sprayed orchards, are commonly severe,

unless the fungicidal program is built on the newer knowledge of epidemic development and prevention.

#### How Scab Epidemics Develop

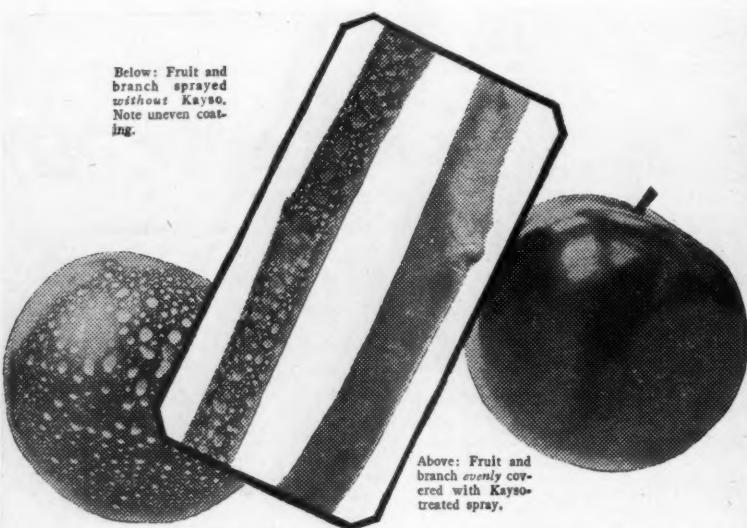
IT HAS LONG been known that the scab fungus overwinters in the dead apple leaves on the ground. Winter spores are produced in these leaves and discharged into the air during spring rains. They are carried by the air to the young leaves and buds, flowers, or fruits, where they cause infections from which quantities of summer spores develop. The relations of this infection to

epidemic development were long a matter of doubt. Is the abundance of this infection important, or does it merely serve the purpose of establishing the fungus in the trees, where it can spread rapidly by means of summer spores? When does infection by winter spores take place, and to what extent? Must the spraying program protect against winter spore infection, or is it sufficient to spray against the summer spores?

Recent work has done much to answer

the scab fungus in orchard air has been followed throughout several seasons. During heavy discharges, it is common to find from 50 to 300 per cubic foot of the orchard air filtered.

This work and detailed observations of early infection show that the winter spores may occasion very heavy infection, and that the spray program must give primary consideration to defense against them. This early infection is of great importance, not only for the direct damage it does, but for establishing the fungus in a favorable position for further spread by summer spores. The time and amount of infection by winter spores are major factors in determining the severity



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Yet, it actually adds only 2% to the total cost. Isn't it worth that 2% to guarantee full value for your materials and labor—and full protection for your trees and fruit? It takes only a pound of KAYSO to 100 gallons of mixture.

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SPRAY AND  
MAKES IT  
STAY**

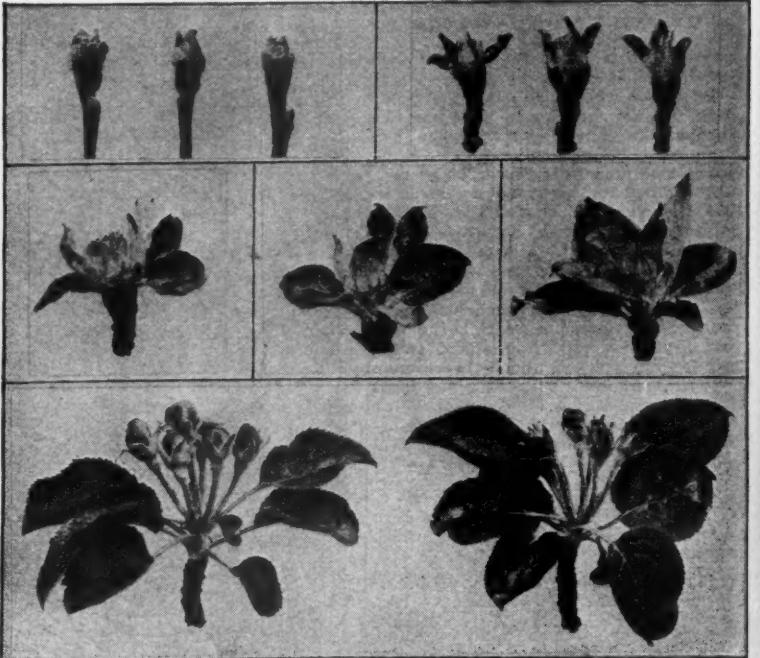


Figure 1.—Critical Stages for Scab Control

Upper row: Delayed dormant or green tip. Sepal infection may occur at the earlier stage. Middle row: Pre-pink or closed cluster. Under epidemic conditions good protection through these stages is usually very important. Lower row: Pink or open cluster. All pre-blossom spray programs should include a treatment at this stage.

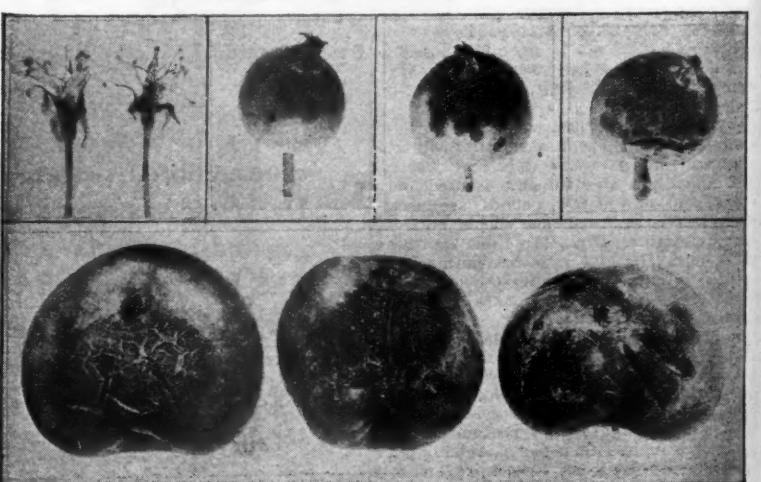


Figure 2.—Results of Sepal Infection

Summer spores from infected sepals are washed over the adjacent surfaces and cause severe secondary infection. The control of sepal infection should be one of the first aims in effective spraying against scab.

these questions. It has shown that, in the areas where scab is more serious in its outbreaks, discharge of winter spores commonly begins by the time the tips of the young leaves and blossom buds are exposed in the unfolding "cluster" buds and may continue until after petal-fall. In Wisconsin, the heaviest discharges commonly come before the blossom buds separate in the clusters. By means of filtration apparatus and microscopic study, the quantity of winter spores of

of the epidemic and its difficulty of control.

Sepal infection commonly plays a very important part in the development of scab on the fruit and adds greatly to the difficulty of control. The sepals (the pointed parts of the calyx) of the blossom buds are exposed in the earliest stages of "cluster" bud unfolding, shown in figure 1. They may be infected at this or later stages. Summer spores are produced in great abundance on the diseased

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## AMERICAN FRUIT GROWER MAGAZINE

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sepals, from which they are washed over the surface of the blossoms or young fruit, where they cause heavy infection (See figure 2). Such infection commonly renders the fruit unmarketable. Most cases of severe scab which cause dwarfed and malformed fruit result from sepal infection. The prevention of sepal infection is one of the prime purposes of the pre-blossom spray treatments.

*The Pre-Blossom Fungicidal Treatments*

**T**HE PROBLEMS of scab control vary greatly from year to year and in different regions in the same year. It is suggested that advantage be taken of advice based on local experience from reliable sources, such as representatives of State agricultural experiment stations or the United States Department of Agriculture. While no single fixed program of spraying can be recommended to meet all conditions, certain principles may be mentioned and suggestions offered.

Control in the early season is the key to successful spraying against scab. The difficulty of control in the pre-blossom period is greatly increased by the fact that new leaf and blossom tissues are continuously being exposed as the buds unfold and growth proceeds. There is usually danger of infection, if suitable weather conditions develop, throughout all the stages shown in figure 1.

In situations where scab development is not severe, two pre-blossom treatments will suffice. In commercial orchards in Wisconsin three applications are commonly necessary, and in very severe cases four are needed. One is always made at the pink or open cluster stage (See figure 1). If only two pre-blossom treatments are used, the first may be made in the late delayed dormant or early pre-pink stage. If three are used, they may come in the delayed dormant, pre-pink, and pink stages. An additional pre-pink treatment is needed in the most severe situations.

The time and number of treatments should be modified to suit the individual situation, with the aim of maintaining adequate protection through the critical pre-blossom period.

*The Effectiveness of Fungicides Applied Soon After Infection Begins*

**J**IT HAS COMMONLY been thought that, in order to protect against scab infection, the fungicide must be applied before infection occurs and serve as a preventive. Recent work has shown that some types of sulphur preparations can control scab when applied soon after infection begins. Experiments have been conducted on potted plants in the greenhouse under controlled conditions in which fungicides were applied in various relations to artificially regulated infection periods.

While this work was done under glass and was concerned chiefly with leaf infection, confirmatory results are being obtained from orchard spraying experiments. Dusts and wettable sulphurs have shown little effectiveness in controlling scab when applied after infection had occurred. Lime-sulphur (1-40), however, has given excellent control when applied from one to two days after the beginning of infection periods. Much reduction in scab development has resulted from applications made three or four days after infection periods began. The results indicate that, in emergency situations where critical infection periods occur when the trees are not well protected, much benefit may result from sufficiently prompt spraying with lime-sulphur after the infection occurs. The addition of arsenate of lead in the usual dosages for insect control increases the fungicidal effectiveness of the lime-sulphur.

*Experiments on Fall Spraying for Scab*

**E**VER SINCE the winter spore stage of the scab fungus was discovered, investigators have sought means to check its development in the hope of bettering scab control. Various methods of mechanical disposal or chemical treatments of leaves have been tried, including fall applications of certain fungicides. While many of the methods used were partially effective, none has been fully satisfactory, and the suppression of the winter stage of the fungus has not played a large part in the scab control program.

In the scab investigations at Wisconsin, demonstration of the importance of the quantity of winter-spore infection in

the development of epidemics led to a renewed effort towards the suppression of the winter stage of the fungus. A weak point in the life-history of the fungus comes after apple harvest and before leaf-fall. At this time, on many varieties and in many locations, it is possible to cover the leaves thoroughly with stronger materials than can be used safely for summer spraying. In summer spraying, the program is primarily defensive. The parasite is permitted to develop its winter stage, and the attempt is made to protect susceptible parts by spray or dust through long growing season. The fall spray treatment is a direct offensive measure against the parasite, with the aim of reducing it to such a low quantitative level that it may be economically and safely controlled by a limited program of summer treatments.

Experiments on fall spraying have been in progress at the University of Wisconsin for several years. Samples of the sprayed and unsprayed scabby leaves are overwintered in the orchard in open-mesh cloth bags, under conditions which favor the development of the winter stage. Microscopic examinations are made in the spring and records are taken of the number of winter-spore cases which develop in the leaves.

Many materials have been used in various concentrations and combinations.

Representative summer spray materials were not effective. It was realized that the purpose was quite different from that of summer spraying, and that specially adapted materials should be sought.

Of many compounds tested, certain arsenical preparations have given the most promising results. In the past season's trials, several preparations reduced the number of winter-spore cases which developed in the treated leaves to less than one per cent of those developed in similar untreated leaves.

If these results are representative, the fungicidal efficiency of these preparations should be satisfactory. The materials are cheap and easy to handle. However, there is still doubt as to whether they can be made safe enough from the standpoint of spray injury, and it remains to be demonstrated in the orchard that the treatments will have the effects on scab development and control that they seem to promise. The method is still in the experimental stage, and fruit growers are cautioned against trying it, unless it can be satisfactorily developed and thoroughly demonstrated as safe and effective.

The results so far obtained seem to be encouraging, and the investigation is being continued. In the meanwhile, the orchardist who does his spring and summer spraying thoroughly according to the best methods now available may expect to

be well rewarded for his efforts and should control scab satisfactorily unless confronted by unusually adverse seasonal conditions.

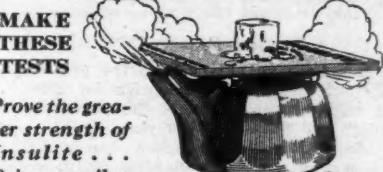
*New Peach Experiment Station*

**T**HE GEORGIA State Board of Entomology has just opened a peach experiment station at Thomaston, Ga., for the assistance of peach growers throughout the section, according to Manning J. Yoemanns, State entomologist. W. C. Clarke, who has been assistant entomologist at the South Carolina Experiment Station, at Clemson College, S. C., will be in charge of the Thomaston station, which will be similar to the one which has been operated at Cornelia for the apple growers for a number of years.—J. H. Reed, Georgia.

The use of commercial fertilizer in the United States dates back to 1830. In that year the first shipment of nitrate of soda was brought to this country. Used ever since, this fertilizer now occupies a distinct position among the inorganic materials utilized for agricultural purposes. With the exception of lime and marl, it has probably been used the longest of any of the so-called commercial fertilizers.

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# QUESTIONS and COMMENT

Conducted by T. J. TALBERT

Questions on fruit growing problems and on general horticulture will be answered through this department if of general interest. For reply by mail enclose 2c stamped envelope (air mail 5c). Address AMERICAN FRUIT GROWER MAGAZINE, 53 West Jackson Blvd., Chicago.

## Sprays and Spraying

**A**LL GOOD FRUIT growers now agree that spraying is the most important orchard practice. It is the cheapest insurance against failure. The fruit grower who fails to spray thoroughly, properly and at the right time will not succeed; even though he may use the best known cultivation practices, pruning methods and fertilization systems. When the results and costs of efficient spraying are carefully considered the orchardist will find that he can well afford to give the practice first consideration.

### Some Principles of Spraying

**T**HE FRUIT GROWER should keep in mind the fact that the fungicidal sprays, such as lime-sulphur and Bordeaux, prevent the diseases instead of curing the plants of them. It is highly important, therefore, that the sprays be applied at the right time, to prevent the spores or so-called "seeds" of the fungus from germinating and growing. Fungous diseases are spread by such agencies as the wind and rain. Once such growth or infection is started in the leaf or fruit, the sprays are valueless because they do not penetrate the surface of the plant tissues.

A protective spray or dust applied as a covering on the susceptible parts kills the fungous spores alighting on the coating before they have an opportunity to cause infection. In all spraying operations, therefore, it is important that all susceptible parts of the plant be kept thoroughly covered and that the new growth be sprayed often enough to prevent the germination of fungous spores and later injury.

One of the most important essentials in spraying is thoroughness of application. The spray may be applied at the right time, in the right way and with the right materials, but, if it does not entirely cover the parts of the plant needing protection, it is not likely to be effective.

### Spraying Results, 1929

**J**IN CONNECTION with the problem of the spraying campaign for 1930, it is interesting to note the results of Jones and Smith for last year, 1929.

**S**mith Reports.—Out of a crop of 600 bushels of apples, orchardist Smith reports that only 93 scabby and blotted apples were found and only 165 worms and very few stings were observed.

Smith used three pounds of lead arsenate and two to two and one-half gallons of lime-sulphur to 100 gallons of water, to which was added one-half pound of Fluxit and one-half pint of nicotine sulphate. However, the nicotine sulphate was used only in the first four cover sprays largely for the purpose of keeping down an aphid attack.

Six cover sprays were used following the calyx application, making in all, including the cluster bud and calyx sprays, eight spring and summer applications. Moreover, Smith also states that on the average he applied during each application about 20 gallons of spray to each tree.

**J**ones Reports.—Out of a 600 bushel apple crop there were less than 150 bushels free from worms and stings and only about 50 bushels of the whole lot were free from apple scab and apple blotch.

Jones used two pounds of lead arsenate per 100 gallons to which was added from two to two and one-half gallons of lime-sulphur. Including the cluster bud and calyx sprays, five applications were made.

It is also interesting to know that an average of about five and one-half gallons were applied to each tree at each application.

It is certainly obvious that Smith sprayed about four times as thoroughly and twice as timely as Jones. Moreover, it is also possible that Smith got somewhat better coverage from the use of Fluxit and that some material benefit may have been derived in the early applications from the use of nicotine sulphate. It is believed, however, that the greatest difference in results was due to more thorough and timely spraying. The additional applications which were continued up until within four or five weeks of harvest time undoubtedly played an important part in control. The thorough and timely early sprays cut down the number of codling moths.

### What About Spray Residue?

**T**HEN THE GROWER considers the making of from six to eight or even more spring and summer applications, he is at once confronted with the problem of: "How shall I handle the spray residue, should there be any?" In answering or considering such a question, would it not be well for the grower to say to himself, as well as to others: "I would rather have spray residue to remove by washing or wiping than to have wormy, scabby and blotted apples." In the climate of the central States it is possible for the grower to spray as many as six or seven times and still produce apples free enough from the spray residue to be well within the standard tolerance.

The grower can always clean or remove the residue from his fruit and generally at small expense. In the case of apple worms and diseases, such as scab and blotch, affecting the fruit at harvest time, there is nothing that the grower can do about it. He may look at the apples and say: "Well, it is too bad. They are wormy, scabby and blotted." The result is a greatly reduced price or a total loss on a large portion of the crop.

### Continue Vigorous Spraying

**T**HERE CAN BE no let-down or slowing up of either sprays or dusts in the control of diseases and insects injurious to the fruit and foliage. For the past two or three years, due to the residue problem, many growers have lost much money through the production of a poor grade of fruit. This was brought about largely due to the fact that they believed they could produce nearly as good fruit with less sprays or dusts and at the same time get around the spray residue problem. Such methods will not work. The grower must spray and dust effectively, efficiently, and timely up until within four or five weeks of harvest time. Then there will be plenty of time to take care of the spray residue problem should there be one.

### Every Orchard Different Spraying Problem

**N**O TWO ORCHARDS are alike in regard to the occurrence or the severity of attack of the common injurious diseases and insects. Where the grower, therefore, has sprayed his orchard properly for a number of years and knows the insects and diseases that are present, he may be able to change or vary spraying suggestions, making the interval between applications longer or shorter as required. He may also change the kinds and proportions of spraying chemicals. If he knows his conditions and has studied his problems carefully, the alterations made may be beneficial and at the same time less expensive.

As a rule directions and discussions on spraying are given primarily for the beginner. Moreover, it is assumed that all the pests requiring control by spray-

ing are present and need sprays directed against them. An effort is usually made to be as specific, clear, and exact as possible. The beginner particularly must realize, however, that some thought, effort, and time must be devoted to the problem of spraying fruits in order to understand suggestions and recommendations.

### Order Spraying Materials Early

**J**IT IS VERY important that the orchardist determine the amount of spraying materials needed for at least the dormant spray and two or three summer applications, and in most cases it will pay to order at one time enough materials for the application of all the summer sprays as well as the dormant, if it has not already been made. Too much emphasis cannot be placed on the matter of ordering the spraying materials well in advance of the time when they will be needed.

This is true because there is always a great rush for materials at spraying time, and it may be difficult for the companies to handle all the orders promptly. Delays may also occur in transit by freight or express. If one or two early sprays are omitted because the spraying chemicals fail to arrive in time, the prospects for a fruit crop may be ruined. In many communities fruit growers combine their orders for spraying chemicals and have them shipped together in large quantities, thus making a saving in freight charges and usually also in price.

### Have Spraying Equipment in Order

**T**HE FRUIT GROWER who runs out his spraying equipment from winter quarters in February or early March, inspects it carefully and secures all needed parts and accessories, is planning ahead profitably and doing much to prevent costly delays and failure during the busy spraying season. Much more time may be had for a careful study and consideration of the spraying equipment and its needs for effective spraying work if such matters are given attention during the winter before spring spraying work begins.

Great emphasis should be laid upon seeing whether the spray pump, valves, nozzles, hose, and other parts and accessories work properly. It is wise also to provide before the summer spraying work begins, an additional supply of the parts and equipment likely to break or wear out rapidly.

## QUESTIONS and ANSWERS

### Prevent Damage to Peaches by Spraying

**W**hat is the best material to use to spray peach trees affected with brown rot? What causes the peaches to fall from the trees when about the size of bird's eggs? What can I do to stop the white worms? —I. A. D., Georgia.

**S**EVERAL different kinds of spraying materials and dusts may be used effectively in spraying peach trees to prevent damage to the fruit during the spring and summer. Moreover, chemical concerns prepare special products for spraying and dusting peaches.

Some of the best home-made chemicals consist of self-boiled lime and sulphur and dry-mix sulphur lime. On account of ease of preparation and less nozzle clogging, dry-mix sulphur lime is generally preferred.

The dry-mix sulphur lime may be made as follows:

64 per cent superfine (dusting sulphur)  
34 per cent hydrated lime  
4 per cent dry calcium caseinate

To make 50 gallons of spray mixture use:

Sulphur ..... 8 pounds  
Hydrated lime ..... 4 pounds  
Calcium caseinate .... 8 ounces

The above amounts may be proportionately increased or decreased to meet the capacity of any particular spray tank.

In the preparation of the mixture, the proper amounts of the ingredients should be mixed thoroughly. A screen having 12 to 14 meshes to the inch may be used to advantage in pulverizing the mixture. The dry mixture thus obtained will keep indefinitely if stored in a dry place. As a spray, it should be used at the rate of 12½ pounds to 50 gallons of water. Arsenate of lead should be added to this spray as with other summer sprays at the rate of one pound to 50 gallons.

If arsenate of lead is added and the applications are applied thoroughly, protection against the plum curculio should be given. This is the insect which we believe is responsible for the white worms which you mention. You should depend upon spraying to control this pest.

### Brown Rot Control

We have three varieties of plums and they all rot and drop off. Previous to dropping, a brown spot appears on them. We sprayed last year with a sulphur mixture but it did not do any good. We were told that we sprayed too late. Please tell us what kind of a spray to use and when to use it. Would the spray be good for other trees? —G. T., Missouri.

**Y**OU WILL FIND full information relative to the control of brown rot, which is undoubtedly the cause of the dropping of your plums, in the January issue of AMERICAN FRUIT GROWER MAGAZINE, page 12, under the discussion, "Rotting of Plums."

In this connection, it is important that thorough spraying be emphasized. If for any reason the spraying work is not done thoroughly and the sprays are not applied at intervals of about two weeks, good re-

sults from spraying cannot be expected. Sprays protect only when they cover the surface which is subject to the attack of insects and diseases. Moreover, where insects and diseases are serious on any fruit, it is important that the spraying work generally be continued up until within about a month of harvest time.

The spray recommended for peaches would, of course, do some good in controlling the diseases and insects affecting apple trees; but since we generally use stronger fungicides for apple trees than for peach trees, it is suggested that you use the regular sprays recommended for apples. These sprays consist of lime-sulphur solution or the so-called dry lime-sulphur and arsenate of lead. The lime-sulphur solution is usually used at a dilution of one and one-fourth gallons to 50 gallons of water, to which one pound of arsenate of lead is added; while dry lime-sulphur is used at the rate of three to five pounds to 50 gallons of water, to which one pound of arsenate of lead is added.

The periods of application for apples are generally just before the trees bloom, or at the cluster bud period, again at the calyx period when the bloom drops, and later applications are applied as cover sprays at about two-week intervals up until within about four to six weeks of harvest time, making in all about seven spring and summer applications.

### Fertilizers Hasten Growth

I wish to hasten the growth of some of the trees in my three-year-old apple and peach orchard. Can I put bone meal or some other good fertilizer in the ground around these trees in early spring by making six or more holes near the trees with a stick or gas pipe? What can I put in the ground when planting trees this spring in order to hasten growth? —E. A. R., California.

**S**OME GROWERS employ a crowbar or other implement in making holes around fruit trees as well as shade trees in order to deposit in them fertilizer during the spring and summer. This is not necessary, however, particularly in the case of fruit trees, as cultivation should be given trees three years of age, and if the fertilizer is spread on top of the soil just about the time growth is starting in the spring, it should be taken up by the roots of the trees without any material loss.

For apple trees about three years old, one pound should be sufficient of either nitrate of soda or sulphate of ammonia applied around the tree under the spread of branches about a foot or so away from the trunk. Bone meal might be used, but the fertilizers mentioned above will perhaps give the quickest response and, in general, be more valuable to the young trees.

When planting trees next spring, if you are able to procure well-rotted manure, a few shovelfuls of this mixed with good rich top soil and then placed in the bottom of the tree hole should be helpful to the growth of the transplanted tree.

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It is important that the transplanted tree stand, when the work of planting is completed, about an inch or an inch and a half deeper in the soil than it stood in the nursery row.

#### Piece Roots as Satisfactory as Whole Roots for Grafting

I would like to know if an apple tree grafted by the piece root method will in later years make as good a tree as one grafted on a whole root. Most of my trees are on whole roots, but I have some piece-root grafted trees. All the trees are young now and I see very little difference, but a fruit grower friend told me the piece root trees will show up weak as they grow older.—J. S. H., Tennessee.

**T**REES propagated by piece root grafting should in later years be just as satisfactory as trees which have been propagated upon the so-called whole root. Whole root trees in the nursery row may grow a little faster during the first year or two after the grafting work. In later years, however, no difference in growth and development has been noted. Moreover, the trees grafted upon the piece roots have borne just as much fruit and lived just as long as those grafted upon whole roots.

It is important in this regard for the purchaser to insist upon healthy, vigorous young trees with good root systems. When this is done, the particular method of propagating does not make any material difference.

#### Planting Raspberries Where Strawberries Grew

Is it all right to set raspberry plants in an old strawberry field I plowed under this fall? And is it advisable to set strawberry plants in an old raspberry patch? What do you think of mulching between the strawberry and raspberry rows with leaves to keep down the weeds? —H. J. K., Indiana.

**W**HEN the leaf roller, a biting and chewing insect, of both strawberries and raspberries has been serious, it would not be advisable to follow either crop with the other. Otherwise, on suitable soil well prepared, good plants of either of the fruits should be profitable if given proper care and attention.

Leaves lay so close together when used as a winter mulch that they are likely to do injury to strawberries by smothering. This may be especially true where heavy mulch of several inches is applied. Since strawberries require, for best results, thorough and timely cultivation, particularly after harvest, leaves would not be apt to give the returns desired.

It is possible that raspberries would do better than strawberries if mulched with leaves to keep down weeds. Good cultivation from early spring to late summer, July and early August, should give better results.

#### How and When to Prune Hedges

Please tell me when and how to prune hedges.—P. A. B., California.

**H**EDGES are pruned in various shapes and to various heights, depending upon the notion or fancy of the pruner or the owner of the grounds.

For low ledges near the house, a box form, flat on top, is usually preferred. This may be procured through the use of hedge pruning shears, which may be purchased from hardware concerns or houses making a specialty of the sale of pruning implements.

The work of pruning hedges may be done during the dormant season, or winter, or it may be delayed until next spring when growth is starting. In order to maintain the hedge in perfect condition, it may be pruned throughout the growing season at intervals of every three or four weeks or as often as necessary to maintain the form desired.

#### Frost Protection in Deciduous Orchards

Do you consider orchard heating a practical practice?

Do you consider a good site approximately five miles from the lake (Lake Erie) any better as regards late spring frosts than a good site approximately 40 miles from the lake?

Is there any data published about orchard sites which would go somewhat into detail on the subject of frosts as regards different locations and the temperature of the air at different elevations, etc.?—V. V., Ohio.

**O**RCHARD HEATING in some of the citrus groves of California has been proven to be a success. In other regions of similar climatic conditions, the same is also likely to be true. Such conditions, however, as obtain for citrus fruits are in general entirely different from those conditions experienced in the growing of deciduous fruits.

Orchard heating is not likely to pay with deciduous fruits unless injury from

spring frosts is the limiting factor in crop production. In other words, unless the spring frosts of a controllable degree are the only factor which stands between the grower and a profitable crop. In fact, it is important that every other orchard management operation should be looked after before it will pay to resort to the fire pot. Many sections rarely have the crop reduced by frost injury in the spring.

There are, of course, some apple orchards of the central and east central States in which heating may probably come to be a common practice, but they are, as a rule, the exception. It is one of the last practices of fruit growing to be resorted to and the largest percentage of growers will generally receive greater returns for their time and money in caring for their orchards through the best known cultural practices without resorting to heating.

The above statements are in general true for the following reasons:

1. When killing frosts are experienced, the temperature usually drops too low to be controlled by the best known orchard heating practices.

2. Periods of anywhere from six or seven years up to as many as 12 or 15 years may occur without the necessity of resorting to orchard heating.

3. Orchard heating, although needed, and where it may prove to be an economic necessity, will not be a success unless every detail of the practice is carried out with precision and upon a strictly painstaking and business-like procedure.

4. The cost of the operation is considerable, and when added to other orchard management expenses, cannot as a general rule from the returns expected from the practice, be a paying proposition.

Considerable information and data have been published in reference to orchard sites, danger from frost, frost protection and the like. Some good references are: United States Department of Agriculture Bulletin 1096, "Frost and the Prevention of Danger by It," by C. F. Marvin, Chief, United States Weather Bureau, 1917; University of California Bulletin 398, "Orchard Heating in California," by W. R. Schoonover and Robert W. Hodgson, 1925. "Fruit Growing," by William Henry Chandler, which may be purchased from AMERICAN FRUIT GROWER MAGAZINE.

#### More About Paw Paws

Permit me to add my experiences to Prof. Talbert's experiences on propagating paw paws in the November FRUIT GROWER.

The paw paw is a seemingly hard species to propagate because of our lack of knowing how to do it, which seems so true in many fields of horticulture. My experience has been, and the same is true of some of my co-experimentors, that the paw paw seed and trees must be planted about a foot deep to keep them from drying out. The first paw paws I transplanted were planted very shallow because I had found they seemed to be very shallow rooted in the river beds. I shaded them but they all died. Other experiments have proved that it is essential to plant these cuttings or plants

about a foot deep. I understand some people shade them and some do not, but with deep planting they will not dry out until they get started. To prove this one can go back to the river bottoms and find that even though they do have a lot of very shallow feeders and long runners, some roots go remarkably deep.

In planting the seed, it is best to stratify it in sand and then plant it the next spring. I had one batch of seed that I didn't get stratified in the fall, so I soaked them 18 days to get the hard shell softened up, and then planted them about 12 inches deep and got them to come up as thick as hair on a dog's back; however, it was late when they started to grow and then they had so far to travel before they got to the atmosphere that it was very late until they came up. They were very immature and all winter-killed. Since then I have been too busy with my nut experimentation to do any more work with them.

However, I have a warm spot for paw paws and would be glad to co-operate with somebody in growing them.

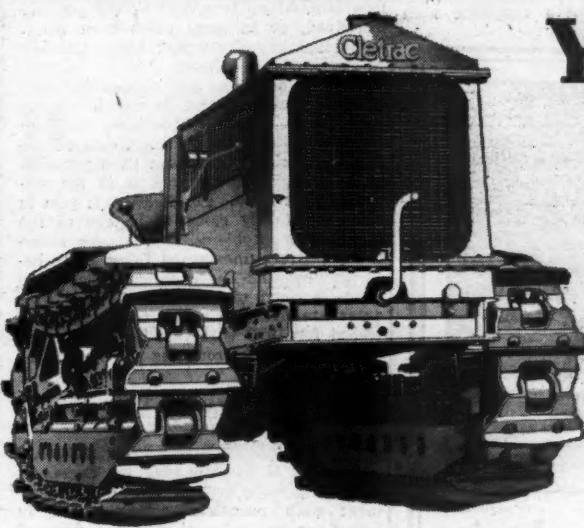
I might suggest that the present popularity of Holland Peat Moss might make it an available and valuable mulch to use on paw paws so that they could be planted more shallow and would not dry out.—John W. Hershey, Pennsylvania.

#### Rough and Warty Apples

Can you tell me what causes my Gano apples to be rough and warty? Also, what causes my Wilson Red June apples to rot on the tree? I spray them the same as I spray the other varieties.—R. E., New Mexico.

**I**N ALL PROBABLY the roughness of your Gano apples is due to (To Page 29)

# The Biggest Tractor Value You Can Buy!



**Cletrac**  
"Twenty"

**T**HERE isn't a more capable or better qualified tractor built for the work of the fruit grower than this rugged, powerful, sure-footed Cletrac "20." Here is every desirable feature you could ask for in a tractor; a full 20 horsepower delivery at the draw bar—positive traction in loose and muddy soil and on steep grades—low, compact build for getting close in to trees—short turning radius and quick response to controls—an extremely light tread that avoids soil-pack—exceptional economy in fuel and oil consumption.

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# IN DEFENSE OF OUR FOOD CROPS

Conducted by

**WALTER COLLINS O'KANE**  
Chairman, Board of Governors,  
THE CROP PROTECTION INSTITUTE



## What Insects Will Be Troublesome This Year?

WITH MID-WINTER on hand and spring not far away, the fruit grower is again approaching the season when the various insect pests, new and old, begin once more to demonstrate their capacities for mischief.

No one can predict just what developments the new season will bring. There are always some surprises every year, some pest or plant disease that suddenly crops up to cause trouble. Sometimes a well-known species that has been relatively innocuous for years becomes unexpectedly abundant. A combination of conditions, such as weather, scarcity of natural enemies, or what not, works in its favor and it responds by an abnormal increase in numbers and destructive powers. Sometimes the scales balance the other way and serious threats fail to materialize. Now and then a newcomer that no one ever thought of before proves to have become established.

No one can offer any detailed predic-

tions. But it is worth while to look over some of the developments of the season now closed and to see what they suggest.

### Codling Moth an Old and Serious Apple Pest

THE CODLING MOTH wound up the year with an increase in numbers in various apple regions, as compared with earlier parts of the season. Warm weather gave it an opportunity to develop a partial additional breed and to extend its activities to a late date. In one way or another this pest continues to hold a place in the front rank, and it will no doubt retain its position in 1930. The problem of spray schedules to control it is still awaiting further solution, and is now complicated by the necessity for avoiding sprays that may leave an objectionable residue on the fruit in late season applications, unless the fruit is to be washed. East of the Rockies the question of combining a fungicide with

an insecticide in late season sprays is also to be taken into account.

The sum of it all is that we do not yet know exactly the right way to manage this pest. We have had it with us since before the Revolutionary War, but although more than 150 years have now elapsed, the insect is certainly going to be destructive and difficult to deal with in the fruit season now at hand. Chemists and entomologists have plenty to do in 1930 in finding improved control measures to offer the growers.

In contrast, the apple flea weevil, which has been steadily on the increase for a number of seasons in certain regions, gives promise of retiring to a less threatening position. Parasites have increased in numbers, and its curve of abundance has taken a downward slant.

### Oriental Fruit Moth Promises to Be Destructive

ON THE OTHER SIDE of the column again we have the oriental fruit moth, which has rapidly moved up to front rank, both in abundance and in extent of territory occupied, and is today one of the most destructive and difficult insects with which this country has to deal. In the Northeast, the pest has moved up into Massachusetts, in the central States it now extends north to the lakes areas, and in the Southwest is showing up in numbers in territory including Arkansas. Fortunately for the apple grower, it does not usually attack apples except under special conditions, but, unfortunately for the peach grower, it has become enormously destructive in that fruit. For example, in some eastern States the percentage of wormy fruit has now climbed up to a half of the peaches examined, or in some cases even more. Individual growers report losses running to thousands of dollars.

Control measures are necessarily only in the making. There is much to be worked out, and there has been too little time to solve the problem. Some of the measures tried last season gave promise, and these will be followed up in the season now at hand. For 1930, this pest is almost certainly going to be one of the outstanding problems, and unless something entirely unexpected takes place between now and the coming summer, the losses in peach orchards in very extensive areas are likely to be all too large. The record for 1929 with this insect gives altogether too unpromising prospects for 1930.

### Growers Advised to Keep Up Warfare on Peach Borer

THE PEACH BORER, on the other hand, is now showing the effects of wider and more general use of the treatment with paradichlorbenzene, and in large numbers of orchards has dropped back to the status of an insect of lessened importance. There are regions, unquestionably, in which damage continues to be considerable, noticeably in the southern peach areas, but in general, conditions are much improved and they should remain so. The danger now is that growers may relax their vigilance and begin to omit treatment, considering that this pest will take care of itself. Similar cases have occurred in the past. If such a move should become general, the pest is likely to again move up to greater prominence.

In fact, with this, as with some other pests, one of the factors entering into establishment of relative abundance is the extent of control measures as practiced over large areas and by a large percentage of growers, where such measures are definitely successful. Other factors also enter. Often these other items far outweigh the effects of artificial control. For example, the abundance of parasites, or the effects of weather, or the results of cultural methods followed, may exert a preponderating influence season by season. But the fact remains that certain pests show the influence of the general practice of artificial control. Where such is the case, relaxation of such control may result disastrously. The lesson of this with the peach borer, for 1930, is to keep up the warfare.

### Apple Maggot May Be Troublesome

IF THE SEASON just past is any index, the apple maggot or railroad worm is likely to be one of the leading pests in 1930 with certain varieties of apples and in extensive regions in the

northeastern part of the United States. This insect is always present in large numbers in the heart of the territory where it prevails, but usually its excessive abundance is largely confined to the more susceptible varieties, notably early fruit, such as Astrachan, Porter, and others. The trouble is that it extends its attack to other varieties of greater commercial importance. It can go through its life cycle with facility in some fall fruit, such as Wealthy. Also, where early fruit is adjacent to winter varieties it may move over into the latter in destructive numbers. To what extent it may be abundant and serious in the coming season is difficult to predict. It may be destructive and the grower will do well to keep it in mind.

### Protective Sprays for Some Pests Should Not Be Omitted

IN THE GRAPE regions of the north central States, the grape berry moth promises trouble. It was abundant last season in many places. In some areas growers who omitted to spray for it found that 20 per cent or more of their crop was attacked. As with some other pests, the lesson is to watch out for it and to follow a program that will give protection.

The European red mite continues to increase in eastern areas, while the common clover mite gives a similar performance in some apple regions farther West. The two together are now requiring definite and thorough measures of control over large areas of apple orchards, and there is no apparent reason to look for any change in this situation in the season soon to begin. With these pests, the grower who fails to adopt the necessary spray before his trees come into leaf this spring is likely to find himself in a bad way as summer advances, and unable then to correct the difficulty. There is no known effective measure that satisfactorily takes the place of a suitable delayed dormant spray.

### Some Insects Confined to Limited Areas

SOME horticultural interests of more limited area are facing their own problems for the coming season. In the South, for example, the fall webworm reached such abundance this last season as to cause much defoliation of pecan orchards. Since it is a native insect, which is known to go in waves, the prospects for similarly large numbers the coming season are anybody's guess. It may continue at a high level or it may drop back.

The walnut husk fly, which was discovered to have become established in a limited territory in California, apparently yielded to the vigorous campaign directed against it and at the close of the season showed a gratifying low level. In some orchards which gave records of more than 80 per cent infestations the season before, the pest dropped to such small numbers that it was not in evidence, even on thorough examination. It was clear that the treatment was responsible, since orchards not treated continued to exhibit heavy infestation.

Making a game of everyday tasks is one way of teaching children to like the tasks which they have to perform each day.



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Bentonite-Sulphur is composed of finely divided bentonite into which has been fused fluid sulphur. When applied to the foliage it forms a sticky gelatinous film... a film which later dries and (being a colloid of the irreversible type) "sets" permanently. Thereafter it is "non-wettable" and will not be washed off by prolonged periods of rain.

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February, 1930

# Codling Moth Control in the Pacific Northwest

By ANTHONY SPULER

Washington Agriculture Experiment Station

**C**LIMATIC CONDITIONS during the past season have been very favorable for codling moth activity. In the Pacific Northwest codling moth activity extended over a long period of time in both the first and second broods. This condition made it difficult for the grower to keep the fruit protected throughout the season, and many reported losses, because of worm work, to the extent of 20 per cent or more, even when a number of late sprays of lead arsenate were applied.

#### Lead Arsenate When Used Alone Not Effective

**L**EAD ARSENATE has long been the standard treatment for codling moth control, but much general dissatisfaction in its use has been expressed by the grower. Experimental work by the Washington Agricultural Experiment Station shows that lead arsenate used alone is not an effective spray treatment for this insect during second brood activity. During the month of August, 50 per cent of the worms placed on apples immediately after they were sprayed with lead arsenate (two pounds to 100 gallons) succeeded in gaining entry to the fruit without being poisoned. Over 55 per cent gained entry five days after the application and over 70 per cent 10 days after the spray was applied. Since cover sprays are normally spaced about 10 days apart, this decrease in insecticidal value of the lead arsenate is serious.

These tests show that lead arsenate used alone affords but little protection to the fruit from second brood worms.

The degree of control that can be expected in the use of lead arsenate alone depends largely on the amount of arsenical deposited and on the uniformity of spray cover. Increasing the strength of spray and thereby the deposit of lead arsenate on the fruit, will result in increased control but not in direct proportion to the amount of arsenical used. Control of the worms increases rapidly with concentration of the lead arsenate spray until approximately three pounds of lead arsenate per 100 gallons are used, after which added amounts of the arsenical have but little value. Twenty per cent of the worms placed on apples sprayed with lead arsenate used at the rate of seven and one-half pounds per 100 gallons, succeeded in entering the fruit without being poisoned. This was but 10 per cent less than the number that gained entry when only three pounds of the arsenical were used.

Although lead arsenate used alone is not effective in checking serious outbreaks of the codling moth, combinations of this material with either mineral or fish oil have proved effective.

#### Value of Oil Sprays

**H**IGHLY REFINED mineral oils have been used in an experimental way for codling moth control, but their use has not become general because information regarding the type of oil, length of spray, effect on fruit and on spray residue removal has not been available. The results of tests at the Washington Experiment Station and other experiment stations over a period of years now indicate that a limited number of applications (two or possibly three) of an oil with a viscosity ranging from 65 to 75 and a sulphurization test of not less than 85 per cent can be used with safety on apples and pears in the Northwest if not used in concentrations greater than one gallon of oil emulsion per 100 gallons of water.

The addition of one per cent of an oil of this type to lead arsenate results in a spray combination which will kill over 85 per cent of the eggs and which has a larvicidal value much greater than lead arsenate used alone. This combination is more effective in preventing worm entry 10 days after application than lead arsenate used alone immediately after the application.

Mineral oils are also effective when combined with nicotine sulphate. Tests have shown that one gallon of oil emulsion combined with nicotine sulphate used at the rate of one-half pint per 100

gallons gave results equal to lead arsenate when substituted for lead arsenate throughout the season. This combination proved even more effective than lead arsenate when used in the second brood sprays only.

Another combination spray that is much more efficient than lead arsenate alone is fish-oil, one-fourth per cent, and lead arsenate. This combination is over two times as effective as lead arsenate used alone.

#### When Combination Sprays Should Be Applied

**T**HE use of mineral oils with either lead arsenate or nicotine sulphate in more than three applications is liable to cause injury to fruit. The use of mineral oil or fish-oil with lead arsenate will complicate the cleaning problem if used in the late sprays or in many applications. It is necessary therefore to use these com-

bination sprays in a limited way and in such a manner that maximum results will be obtained.

A series of tests were conducted to determine when these combination sprays could be used to best advantage. The oil-nicotine-sulphate combination was substituted for the lead arsenate in these tests and not added to the lead arsenate. All of these tests were compared with lead arsenate (2-100) in six cover sprays.

The results of these tests show that the lead arsenate-mineral oil combination was very effective when applied during the height of egg-laying in both broods (first cover and sixth cover); that this combination was even more effective if applied in the second brood sprays (fifth and sixth covers). The nicotine sulphate-oil combination was as effective as the same number of lead arsenate sprays when applied for the first brood of worms but decidedly more effective than lead ar-

senate when applied in the second brood sprays.

Because the oil and lead arsenate combination has great ovicidal value but complicates the cleaning problem if applied in late sprays, this spray should be used during the first brood activities and at a time when most of the eggs are being laid. The time of heavy egg-laying can be determined by using moth traps as indicators. Oil sprays should, however, not be used in the early sprays if lime-sulphur has been applied after the dormant period.

The mineral oil and nicotine sulphate combination also has ovicidal value and does not complicate the cleaning problem. It should, therefore, be used in the late sprays, where it has also been proved to be most effective.

The doctor answered the phone. Turning to his wife he said, "Quick, get me my satchel. The man says he cannot live without me."

"Just a minute," said his wife who had picked up the receiver. "That call is for daughter."

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# The Market Review

By PAUL FROELICH  
United States Bureau of Agricultural Economics

THE MOST STRIKING feature of fruit and vegetable markets recently was the extremely low point to which shipments dropped during Christmas week and the sharp increase again during early January. Total forwardings practically doubled within 10 days' time, thus indicating the renewed activity of markets after the holiday period. Prices of apples strengthened slightly, and citrus fruit was in a fairly firm position.

Storms and very low temperatures in northern and western distributing areas affected markets to some extent. Frosts which visited the fruit belt in Florida and the Gulf States are said to have done very little, if any, damage to citrus crops. Florida strawberries, however, were set back, and production there may be slightly reduced.

## 1929 Crop Records

AS A MATTER of record, final statistics on 1929 fruit crops are given below:

**Apples.**—The total apple production of 139,754,000 bushels is 25% less than the 1928 crop of 186,893,000 bushels and 24% below the previous five-year average of 183,452,000 bushels. All sections, with a few exceptions, show a substantial decrease from their 1928 production. The average December 1 price of \$1.32 per bushel is considerably above last season's price of 99c. The total value is

estimated to be \$184,107,000, which is about 1% less than the 1928 value of \$185,842,000. Commercial apple production estimated at 28,973,000 barrels is 18% less than the 1928 crop of 35,461,000 barrels and is 11% below the previous five-year average of 32,468,000 barrels.

**Peaches.**—The peach crop amounted to 45,998,000 bushels, which is 33% less than the 1928 crop of 68,369,000 bushels. Production in California was about one-half as much as the large crop of 1928, and the Georgia crop was only 30% of the previous year's production. These States usually produce nearly one-half of the total crop. The value this season is estimated to be \$62,705,000, which is slightly less than the 1928 value of \$63,643,000.

**Pears.**—This season's pear crop is estimated to have been 20,903,000 bushels valued at \$29,952,000, while the 1928 production of 24,212,000 bushels was valued at \$24,663,000.

**Grapes.**—The production of grapes is estimated at 2,022,000 tons, which is about 24% less than the large 1928 crop of 2,671,000 tons. The value of the crop is estimated to be \$59,387,000 compared with \$49,740,000 value of the 1928 harvested crop. The California crop of 1,751,000 tons was all harvested this season, while in 1928 approximately 153,000 tons of the estimated production of

2,306,000 tons of grapes were not utilized. **Cherries.**—Commercial cherry production in nine important producing States was about 18% less than the production of 1928. The loss in volume of production was offset to some extent by higher prices in most of the States. The value of the crop in the eight States reporting price was only 4% below that of 1928, while production in these same States this season was about 16% less than in 1928.

**Cranberries.**—Cranberry production was 541,500 barrels in 1929 and 551,000 barrels in 1928. Increased production in Massachusetts was offset by losses in New Jersey, Wisconsin, Washington and Oregon.

**Citrus Fruits.**—Sharp decreases in citrus-fruit production are reported this year by both California and Florida, and total production of these crops is expected to be one-third less than it was last season. This year's California orange crop, on which picking has begun, is estimated at 23,600,000 boxes, compared with the 38,705,000 boxes picked during the 12 months ending the last of October. The Florida orange crop is estimated at 9,500,000 boxes, compared with 15,000,000 last year. The other States will have about 639,000 boxes, compared with 425,000 last season. The Florida grapefruit crop is estimated at 6,500,000 boxes, as against 10,500,000 produced last year. Other States, including California, Texas and Arizona, have about 2,818,000 boxes, compared with 1,955,000 last year. The California lemon crop is estimated at 5,900,000 boxes, or 2,000,000 less than last season.

**Strawberries.**—The 1929 strawberry crop was finally estimated at 331,441,000 quarts, or about 1% less than the 1928 record-breaking crop. The average farm price of 13½¢ per quart made the total farm value \$44,872,000. Peak movement in 1929 occurred shortly after mid-May, or two weeks earlier than usual. Heavy shipments from Arkansas and Tennessee were chiefly responsible for this peak. Acreage in mid-season States has been reduced for 1930.

## Apples Moving from Storage

ALTHOUGH the January holdings of apples in cold storage were just about equal to the five-year average supplies and 12% less than stocks of a year ago, the net removal of 1,417,000 equivalent barrels during December was somewhat more than removals during the same month in 1928. This means that storage supplies are fast diminishing. The January 1 report showed 1,764,000 barrels, 13,120,000 boxes and 5,476,000 bushel baskets in cold storage. The total holdings were equivalent to 7,963,000 barrels. The supply of barreled fruit was one-fourth lighter than a year ago and 42% below the five-year average for January. Boxes were 5% more plentiful than average but 17% less than a year ago. About 9,430,000 boxes out of the total 13,120,000 were still in Pacific Coast States. Bushel baskets were 29% more abundant than on January 1, 1929, and 108% above the average figure.

## Western Shipments Heavy

MOVEMENT of apples from the State of Washington was more active than that in any other section, though shipments from New York and the Virginias were increasing in January. Washington's commercial crop, equivalent to 8,300,000 barrels, was greater than the combined commercial crops in the next three important States, New York, Virginia and Idaho. About 23,000 cars had moved from Washington by January 10, compared with the next highest figure of 13,000 from Virginia. Movement from all sections during early January was averaging 200 cars daily.

December estimates of the total apple shipments for the current season indicate a possibility of about 100,235 cars, as against 127,530 last season. Apparently most of the remaining supplies will be Washington and New York fruit. Approximately 78,000 carloads had left producing sections by January 10, so that scarcely 25,000 were yet to come.

## Markets Mostly Firm

AFTER a slight decline during the latter part of 1929, apple prices tended upward, partly because of the necessity of covering storage costs. Extra

Fancy, medium to large Winesapse were returning \$1.85-\$2 per box at shipping points in the State of Washington, with Delicious touching \$2.90 and Rome Beautys at \$1.80. Best cold-storage Baldwins in western New York sold at \$1.85 per bushel basket or \$5.75 per barrel, while Rhode Island Greenings ruled \$6.75. Kings brought \$2 a bushel. Barrels of eastern or northern fruit ranged anywhere from \$4 to \$11 in terminal markets, according to variety and source. Chicago quoted bushel baskets of combination-grade Jonathans or Romeas from Idaho at \$2.25-\$2.40, with Delicious up to \$2.85. Medium to large sizes of Washington Extra Fancy Delicious brought \$3.75-\$4.25 per box in Chicago, and Jonathans \$3-\$3.50.

## Good Distribution

ONE IMPORTANT association of packers in the Wenatchee district of Washington distributed apples in 219 cities and towns of the United States this past fall, compared with 193 the previous year. More small towns are taking car lots. One with a population of 637, and another with a population of 988, have each bought a car of Fancy apples. Another town with 2158 inhabitants has bought five cars of this fruit.

New markets for boxed apples of the Northwest are now open in South America, as a steamship line plying between the west coast of North America and the west coast of South America has equipped five of its large ships with refrigerator compartments, capable of carrying 3000 boxes each. Boxed apples had already found their way into some of the towns of the west coast of South America, but heretofore they had been carried 3000 miles across this country and shipped from New York.

## Competition for America

PRELIMINARY surveys of the fruit outlook in Australia for the 1929-30 season indicate an abundant yield in practically all regions, while in New Zealand the outcome may prove to be a record one. It was still too early for any definite forecast of the coming crop, but, if indications of a record production prove accurate, American apples in England and continental Europe will encounter greater competition during the late months of the present United States export season than was experienced last year, when crops in Australia were generally light.

Fruits of all kinds are expected to yield heavily in New South Wales the present season. Quantity and quality are both expected to be high, and the apple and pear areas are looking forward to a large production, according to a trade report. An abundant yield of apples, apricots and other fruit is expected in Tasmania. Last year's crop was light, and prospects in November indicated a much larger production for the present season. With the exception of apricots, all deciduous fruit trees promise good to heavy crops in Victoria and, generally speaking, prospects are good for all classes of fruit throughout Australia.

Russian apples also are being featured in markets of northern Europe. Quality and pack of this fruit compare very favorably with that of shipments from northwestern United States.

Even Shanghai in China reports greater competition for American apples. Fruit has been arriving freely from parts of China and from Japan and Korea, these nearby supplies generally underselling the stock imported from America.

## The British Market

THE BRITISH market was not in very good condition during the holidays. Though apple supplies from America were rather light, trading was limited and prices were moderate. Deciduous fruits from southern Africa were in heavy supply and competed actively with American apples. Citrus fruits also have been plentiful. Though some improvement is anticipated in sales of apples from America, the expected heavy receipts of good-quality fruit from New Zealand and Australia will offer serious competition in the spring.

On the Continent, the outlook for American apples continues relatively favorable in spite of the fact that European storage supplies will probably have to be consumed earlier than would nor-

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mally be the case. Arrivals of American apples at Continental ports remain moderate and the demand generally good, particularly for red varieties and for fruit in good condition. The Scandinavian countries, in particular, promise to be very good markets even in comparison with last year. Boxed apples continue to find generally better inquiry than barrels, although Copenhagen reports improving demand for the latter.

#### Citrus Movement Gaining

DURING the opening week of January, shipments of grapefruit were three times and of oranges two times those of the preceding week. Grapefruit was averaging 100 cars daily, while oranges averaged about 250 cars each day. Imports were very light. Movement of oranges particularly was far below corresponding records of last season. Washington, D. C., reported boxes of medium-sized Florida oranges jobbing at \$4.50-\$4.75, and grapefruit sold there at \$4.50-\$5 per box of medium fruit. Bulk of the Florida grapefruit crop has been moved to market, though fairly large shipments are yet to come. Some arrivals of fresh processed fruit from Florida have not

given entire satisfaction in consuming centers.

#### Florida Berries Prominent

THE FLORIDA strawberry season opened earlier than usual, and shipments have been heavy. Frosts delayed the crop to some extent and may affect the final outturn. By the opening of 1929, hardly any cars of Florida berries had been reported shipped, but by the same time this season about 175 carloads had moved. Acreage in that State is estimated 30% greater than last year, but only a slight increase is indicated for Louisiana. Cold-pack berries from the Pacific Northwest are said to be competing with early fresh fruit from the South, and the cold-pack industry has shown great expansion in recent years. Retail packages of the frozen berries are now available in some cities. The f.o.b. cash-track price of Missionaries in the Lakeland-Plant City district of Florida was 30c-35c per quart or 15c-18c per pint in early January, with demand good. City dealers received mostly 30c-45c on a quart basis, or 18c-25c per pint. The 24-pint crates sold at \$4.75-\$5.50 in the Middle West.

## *Oil Sprays in the Northwest*

THE MEMBERS of the Western Cooperative Oil Spray Project, comprising the experimental stations of California, Idaho, Montana, Oregon, Washington and British Columbia, and the United States Department of Agriculture, wish to make the following suggestions regarding the use of oil sprays on fruit trees in the Northwest, with particular reference to apples and pears. These suggestions are based on data accumulated from experimental work during the past three years.

**Oils for Dormant Sprays.**—1. Dormant oil sprays should be applied in the spring before the bud scales separate and before the buds show green. Injury may result if sprays are applied during the critical period (delayed dormant) of bud development. This period occurs between the time the buds first show green and the cluster bud stage.

2. There is no evidence that low temperatures following sprays applied in the spring during the dormant period result in injury.

3. Oils of relatively low sulphur test (50-70) can be safely used.

4. Stable emulsions have proved safer than quick-breaking emulsions.

**Oils for Summer Sprays.**—The following suggestions are made to growers who are planning on using oil sprays for codling moth control.

1. The number of applications of summer oils should not exceed three, and under most conditions not more than two are advisable.

2. The use of oils alone has not given control of the codling moth. Oils should be used only in combination with lead arsenate or nicotine sulphate.

3. Oils in combination with lead arsenate should be applied during the height of the egg-laying period of the first brood, but if sulphur sprays are applied after the dormant period, no oil should be used in the first brood sprays.

4. Because of difficulty in removing spray residue, the oil-lead arsenate combination should not be used after July 25, but the oil-nicotine sulphate combination may be used after this date.

5. Oils ranging in viscosity from 65-75 have proved most satisfactory, except that for Newtowners or other varieties susceptible to oil injury the viscosity of the oil should not exceed 55.

6. Oils with a sulphur test not less than 85 are satisfactory.

7. Caution: Oils in combination with lead arsenate should not be allowed to stand in pipes or spray tanks, but should be applied immediately after being mixed. Fruit sprayed with this combination after the spray has been allowed to stand in tanks or pipes for some time can be cleaned only with great difficulty. This spray mixture is also ineffective in control.

8. For more specific recommendations regarding the use of oil, local authorities should be consulted.

The following members participated in the experimental work upon which the above suggestions are based:

**British Columbia:** E. P. Venable and Max H. Ruhman, entomologists.

**California:** E. R. deOng, entomologist.

**Idaho:** Claude Wakeland, entomologist; Lief Verner, horticulturist; W. H. Hungerford, plant pathologist; H. C. Magnusson and H. S. Snyder, chemists.

**Montana:** J. R. Parker and W. C. Cook, entomologists; H. E. Morris, botanist; Jesse Green and S. A. Johnson, chemists.

**Oregon:** Don C. Mote, B. G. Thompson, LeRoy Childs and R. K. Norris, entomologists; R. H. Robinson, chemist; and C. K. Reimer, horticulturist.

**Washington:** R. L. Webster and Anthony Spuler, entomologists; F. L. Overley, J. R. Magness and W. A. Luce, horticulturists; E. L. Green and J. R. Neller, chemists; and D. J. Crowley, plant pathologist.

**U. S. D. A.:** E. J. Newcomer and M. A. Yothers, entomologists; H. C. Diehl, C. P. Harley and E. L. Reeves, physiologists; C. R. Gross, chemist; D. F. Fisher and A. L. Ryall, pathologists.

E. J. Newcomer is chairman and Anthony Spuler, secretary.

#### *Phony Disease of Peach*

RECENT investigations of phony peach, show that this trouble is caused by a virus that resides in the roots of the trees. The virus does not enter the branches, buds, scions, or seeds and the disease is communicable only by grafting roots from diseased trees to roots of healthy trees, or by making piece-root grafts in which phony roots are used.

The first symptoms of phony disease do not appear in commercial plantings until the latter part of the second growing season, according to specialists of the United States Department of Agriculture who are conducting the investigations. From this time on the trees may come down with the disease at any age.

When attacked by this disease a tree develops shortened internodes, a large number of lateral twigs, and large, flattened dark-green leaves, giving the appearance of dense growth with healthy foliage. Especially in young trees, a decided dwarfing results. The number of fruits and their size is greatly reduced. Fruit from phony trees is apt to be distinctly poorer in flavor than normal fruit, though slightly better in color.

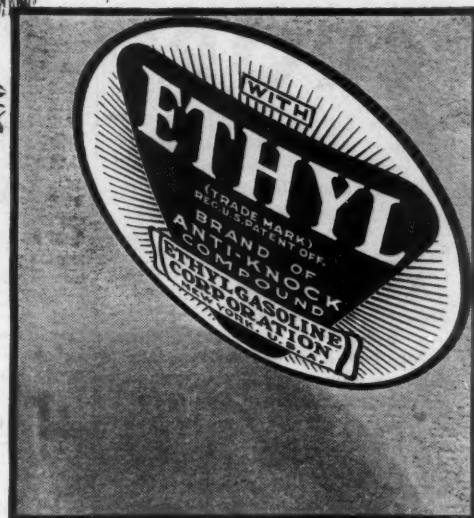
A vigorous campaign is now being conducted for the eradication of the phony trees. This is regarded as the only sure method of controlling the disease in the territory where it has already spread. In the meantime numerous experiments are under way at present in an effort to find a stock that is resistant to the disease.

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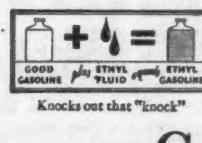
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# More Light on "Instant Bordeaux"

By F. J. SCHNEIDERHAN

West Virginia Experiment Station

SINCE WRITING an article last July for AMERICAN FRUIT GROWER MAGAZINE entitled, "Instant Bordeaux, a Better Copper Spray," the writer has had opportunity to continue his experimental work with this new type of Bordeaux and also to address fruit growers in four different States. The number and nature of the questions asked at such meetings, together with inquiries received by mail, as a result of the article mentioned above, indicate that there is widespread interest of a very lively nature among fruit growers in all sections of the United States in regard to this new method of preparing one of our oldest and best fungicides. Every plant pathologist engaged, like the writer, in public service work, will be gratified to know of this interest because of the urgent need for a larger use of copper fungicides in recent years.

*Why We Need More and Better  
Bordeaux Mixture*

IN THE EARLY spring season, the average fruit grower is keen on the spraying job. He puts forth a fine effort through the dormant, pink, petal-fall and two-weeks spray applications, but after these have been applied, he weakens. The result is that the late summer sprays, in which the spray calendars of most States advise the use of Bordeaux mixture, are either omitted entirely or applied in a slipshod manner.

The neglect of these late summer sprays is one of the contributing causes to the development of certain damaging apple diseases in the eastern sections of the United States, particularly during the past five years. Among these diseases we should like to mention with particular emphasis the development and spread of fruit spot (*Phoma* fruit spot) in the Cumberland-Shenandoah section and in Delaware and New Jersey. An article written by Dr. H. C. Young of the Ohio Experiment Station appeared in the April issue of AMERICAN FRUIT GROWER MAGAZINE. This article is well worth reading because it describes the known facts of the life history of the fruit spot organism, together with an estimate of the losses caused by the disease in Ohio orchards in 1928. This same disease was the most important fungous disease of apples in New Jersey in 1929, and also caused considerable losses in Delaware, Pennsylvania and Virginia during the past year. Fruit spot of apples is not a respecter of varieties and many a grower has been sadly surprised to find fruit which was apparently sound when packed, come out of storage in very bad condition and fit only for the by-products plants.

Another disease which has been increased in intensity and in geographical distribution is cloud, otherwise known as sooty blotch.

*Timely Applications Prevent Infections*

FRUIT SPOT, cloud, apple blotch and bitter rot can be prevented only by copper fungicides as far as we know at present. In fact, Bordeaux mixture is recognized as a specific for these diseases. The fact that fruit spot is increasing in certain sections of the country is well known to the pathologists of those sections who have inaugurated experiments for its control. Data available at present seem to indicate that Bordeaux mixture is the only commonly known fungicide which will control this disease and that the sulphur fungicides will not control it satisfactorily.

Since fruit disease control is 100 per cent prevention, it is not wise to be forewarned about the recent spread of the fruit spot disease as well as other diseases and prepare to prevent its establishment in individual orchards by a sensible use of Bordeaux mixture? It has been the history of most plant diseases that it is easier to prevent their establishment than to effect a cure after they have been established. There is little of virtue and good sense in buying automobile insurance after the flivver has been stolen and, similarly, and conversely,

it is wiser to insure against the diseases mentioned above by timely and proper application of Bordeaux mixture.

*Difficulties Encountered in Old Method  
of Bordeaux Preparation*

AT THE PRESENT time there is a tremendous amount of bluestone and lime used in the United States annually for the preparation of Bordeaux mixture. Most of this Bordeaux is prepared at present according to the old and well-established method of using stock solutions of bluestone and stone lime.

As pointed out in a previous article in this magazine, there are certain inherent difficulties in this old method of preparing this fungicide from regular crystals of bluestone and milk of lime resulting from the slacking of stone lime. These difficulties are so important from the standpoint of labor involved and the end product obtained that we shall, without going into detail, again mention them in this article. In the order of their importance we shall list them as follows: The tendency to either "burn" or "drown" the lime in the slaking process; variability in the quality of stone lime; frequent failure to properly strain the milk of lime after the slaking process; the necessity of having equipment ranging from a few barrel containers to elaborate Bordeaux mixing plants; and the incidental time and labor of preparing stock solutions.

*The New Method of Preparing "Instant  
Bordeaux"*

POWDERED BLUESTONE, sold commercially under the trade name "snow," is substituted for the crystals of bluestone and chemical hydrated lime takes the place of the stone lime in the preparation of instant Bordeaux. Two finely powdered, dry materials are thus substituted for stock solutions of the same ingredients. No barrels or mixing plants are necessary in the new method and instead, the grower needs only a few buckets, a scoop and a kitchen scale, all of which were necessary in the old method. The old job of dissolving bluestone and slaking lime is done away with entirely and in so doing we have found a fool-proof procedure which every grower experienced in Bordeaux preparation will appreciate.

*How to Make a Tank-Load of 2-4-50  
Instant Bordeaux*

THE FRUIT GROWER who wishes to try the new method of preparing Bordeaux mixture should follow the procedure which the writer and many fruit growers in the Cumberland-Shenandoah apple belt have found to be very satisfactory.

1. To prepare a 200-gallon tank full of 2-4-50 Bordeaux, first weigh out eight pounds of powdered bluestone (snow) and 16 pounds of chemical hydrated lime.

2. Fill the spray tank one-fourth full of water and start the agitator, being certain that the agitator works properly because the whole success of the new method is dependent upon it.

3. Add the powdered bluestone by pouring it on the tank strainer and washing it into the tank with the inflowing water.

4. Continue to add water until the tank is about three-fourths full, when the chemical hydrated lime is added, either in the dry form or in paste form, by pouring it on the tank strainer and washing it into the tank as in the case of the blue stone.

5. Now fill the tank and permit the agitator to run a minute longer, after which lead arsenate may be added if needed in that particular spray application.

If the grower will remember that this powdered bluestone can be dissolved in cold water in two minutes with proper agitation, he will have the key to the new method. It is evident that constant agitation from the beginning until the end of the operation is essential and it is apparent that the time required is only

that in which the tank is ordinarily filled with water, hence the name "instant Bordeaux."

*Observations on the Use of Instant  
Bordeaux Mixture in 1929*

AN EXPERIMENT in which the old type of Bordeaux was compared with the instant Bordeaux in adjacent rows of Northwestern Greening, for the control of apple blotch, was conducted in the season of 1929. The regular spray equipment in this large commercial orchard was used for both applications. A total of 1000 gallons of spray material per application was applied in each plat and a representative number of checks or unsprayed trees were used. Three applications of 2-4-50 Bordeaux mixture were made in the three, five and seven-weeks sprays.

The checks developed approximately 50 per cent of blotch, which was a very slight infection compared with previous years. The control of blotch in both plats was excellent, there being less than half of one per cent of blotch or nearly perfect control. The fungicidal value of the two types of Bordeaux seemed to be equal in this experiment but in other respects there was quite a difference.

In the spraying out of 1000 gallons of the old type of Bordeaux, 10 stops had to be made on account of clogged nozzles, while no stop was necessary when 1000 gallons of instant Bordeaux was applied. Furthermore, the time required to prepare the instant Bordeaux (1000 gallons) was only 12 minutes compared with 40 minutes necessary to mix the other type of Bordeaux from stock solutions. This operation includes the slaking of the lime and dissolving the crystals of bluestone.

It is evident that there is a saving of time and labor when instant Bordeaux is used. The milk of lime was strained through cheesecloth and every effort was made to follow the best procedure in the preparation of the old type of Bordeaux but, nevertheless, we experienced clogging of the nozzles and lost time thereby.

*Growers Satisfied*

IN ADDITION to this test, we have had reports from numerous growers who used instant Bordeaux in their orchards in 1929. The consensus of opinion indicates that general satisfaction resulted, and most of the reports indicate that the growers "would never go back to the old method."

The writer has had five years of experimentation and practical experience with instant Bordeaux. This experience, amplified by that of many commercial apple growers, indicates that instant Bordeaux is the result of a method preferable to the old method of using stock solutions of lime and bluestone. Satisfactory Bordeaux can and is being prepared from stock solutions by careful orchardists, but considering the intelligence of average farm help, the new method will result in a better average quality of Bordeaux mixture.

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# A New Pest of the Cherry

By A. A. GRANOVSKY  
Wisconsin Agricultural Experiment Station

**T**HE CONTROL of insects is a subject of the day with the fruit growers who are engaged in quality fruit production. It is often said, in misinformed quarters, that agricultural education leads to overproduction of farm products by teaching how to grow two blades of grass where one grew before. But as a matter of fact a farmer has considerable difficulty to save that one blade of grass from the depredation of insect pests and plant diseases. Not only does he have to protect his crop from insect pests of long standing, but he has to constantly face newly introduced foreign pests, as well as to cope with the native insect species that heretofore were feeding on wild plants but changed their food habits and became a menace of major importance.

#### Feeding Habits of Some Insects Change

**T**IS A WELL KNOWN fact that several native insects of economic importance were at one time harmless and fed on some wild plants of no economic significance. As civilization advanced, however, and crop plants were introduced into new territories and gradually planted over extensive areas, some insects, from time to time, changed their food habits and adapted themselves to new and more favorable host plants. It will suffice to mention the Colorado potato beetle to illustrate the point. As pioneers advanced westward, bringing with them potatoes into the region this insect lived in its natural surroundings, feeding on wild solanaceous plants, it soon adapted itself to cultivated potatoes in preference to its native food. Among the fruit insect pests that have changed their feeding habits from wild hosts to cultivated ones are the peach-tree borer, apple maggot, plum curculio, lesser apple worm, strawberry weevil and a dozen or more others.

The case bearer in question, *Coleophora pruniella* Clemens, from time immemorial has been feeding on leaves of wild black cherry as reported in literature since 1861. In Door county, Wisconsin, it was also observed to feed on the leaves of paper birch for years. Only in the last four or five years a few individuals of this insect have been observed to feed in cherry orchards near wooded lots. A close observation revealed that they have been steadily increasing in numbers in these cherry orchards for the last few years. In the summer of 1929, they appeared in alarming numbers and proved to be a pest of major importance of cultivated cherries.

It is an obscure native species of insect and has never before been reported to be of economic importance on any cultivated crop.

#### Feeding Habits of Case Bearer

**P**RELIMINARY studies show that this species of case bearer overwinters in a half grown larval stage, attached to the bark near the buds, usually in groups from a few to as many as 30 or 40 around a cluster of buds. They are protected by their cases, which they seldom leave throughout the entire larval and pupal stages.

As cherry buds begin to swell in the spring and the green tips of unfolding leaves are protruding from the scales, the case bearers move, carrying their protective cases, to the young foliage for their first spring meal. The larvae have a very interesting feeding habit. With the development of foliage, they firmly attach their protective cases to the lower epidermis of the leaves by webbing and gluing. Being thus attached, the larvae eat a small hole in the epidermis, large enough to allow it to penetrate into the inner part of the leaf.

The larvae feed between the lower and upper epidermis without injuring them, but consume the inner part of the leaf tissue. They feed in their mines until the excavation becomes too large to reach the green tissue without leaving their protective cases. They then move to an uninjured place on the foliage to make new excavations. A larva can make as many

as 10 such mines, from a few millimeters to one centimeter each, before reaching the pupal stage. In time, both the upper and lower epidermis fall out from the injured areas and the leaves have a very ragged appearance. Severely injured leaves turn brown and from a distance the infested orchards appear to have been swept by fire.

Such a method of feeding reduces the photosynthetic area of the leaves and consequently the plant cannot produce the proper growth, develop its fruit or build reserves for overwintering.

Although the larvae feed mainly on leaves, they also attack the flowers, petioles, calyx, petals and even the fruit proper, rendering it unfit for market. A large percentage of the injured fruit drops off the trees, considerably reducing the yield of cherries.

#### Life Cycle

**A**S THE LARVAE grow, they deposit additions to their cases, made of bits of leaves, and in the fully constructed cases one can detect five ad-

ditions, corresponding to the five developmental stages of the larvae.

Upon maturity in the latter part of June, they pupate, usually on the upper surface of the leaves, and after 27 days of pupal rest, tiny gray moths emerge. The majority of moths appear between July 12 and 17, although they continue to emerge until the beginning of August. A few days after their appearance, they lay on the lower surface of the leaves their tiny yellow eggs, singly, from a few to as many as 60 odd eggs to a leaf.

Embryonic development of eggs continues for about two weeks, after which time young larvae hatch from the eggs by way of a hole cut next to the leaf. They begin to mine a minute entrance in the epidermis, tunnelling within the leaves. After completing the first larval stage, the larva makes its first case by cutting it from the upper and lower epidermis of the leaf, and then moves to a new place for feeding. The injury produced by young larvae in making their first protective cases suggests that of the "shot hole" disease of cherry, and, in fact, has been confounded with it by many cherry growers. On account of the severe injury, many trees lose their foliage prematurely and are in danger of being

winter-killed. Before the leaves drop, however, the half mature larvae move to the bark around the buds for overwintering.

#### Difficult to Control

**B**ECAUSE of the protective feeding habits from hatching of the larvae to the emergence of adults, this insect is exceedingly difficult to control. The regular spray schedule adapted by the growers is ineffective, because larvae feed in between the epidermis and cannot be reached with the spray. Foliage may be completely covered with the arsenical spray, yet insects feed on inner parts of the leaves unburnt.

Such phenomena illustrate the ever challenging difficulties constantly met with in the control of many insects of importance. Not only is it necessary to meet new sudden outbreaks of little known insects, but their highly specialized protective adaptations in feeding habits defy even the best methods of control known to growers and entomologists.

Several experimental tests performed in Door county with various oil sprays indicate that there is a possibility of controlling this insect, although with difficulty, by using home-made oil emulsions prepared from lubricating oils. The cherry orchards should be sprayed with an eight per cent oil emulsion during the dormant stage of the tree and before the larvae move to the buds for their first spring feeding.



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# Plum Curculio as an Apple Pest

By W. P. FLINT

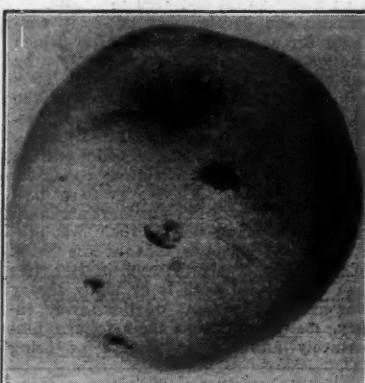
Illinois Natural History Survey

the beetles feed for from one to two months, and then seek out sheltered places in which to pass the winter.

### When to Spray and What Materials to Use

THE CONTROL of this insect depends on keeping the surface of the fruit properly covered with poison at the time that the overwintering beetles are coming out, feeding and laying their eggs.

In Illinois, extensive experiments have been carried on to test the effect of the



Egg Punctures of the Plum Curculio on Apple.

The little grubs hatched from the eggs of the plum curculio work into the core of the apple and usually cause the fruit to drop.

as is the plum curculio. Orchards where this insect is a serious pest are nearly always on rough land, such as hills or river bluffs, on land adjoining ravines, or on brushy wooded areas in which the insect finds ideal conditions for sheltering during the winter.

The plum curculio is a small, hard shelled, humpbacked snout beetle and in the past was considered the most injurious insect pest of peaches, plums and other stone fruits, and even with the introduction of the oriental fruit moth, it ranks as a close second to and is often more important than that insect. In many of the apple growing sections in the States east of the Rocky Mountains it is a very destructive apple pest. It does not occur in the far west, its western range extending to Colorado and the Bitter Root Valley in Montana.

#### Knowledge of Life History and Habits Essential

IN ORDER to understand the control measures which have been found best suited for fighting this insect on apples, one must know something of its life history and habits on this fruit. It always goes through the winter as a full grown beetle, hiding away in various types of shelter. In Illinois a considerable amount of study has been put on the hibernation quarters of this insect and so far at least we have not found that the insect selects any one or two places as particularly favored for winter shelter. Many square feet of woodland, hedgerows, orchard margins, and areas along ravines and gullies about orchards have been examined and considerable numbers of curculios have been found but they have not been collected in any one special place. These insects have been taken in piles of dried leaves in woods; from the bases of clumps of grasses of various kinds; under bark, decaying bits of branch or under the bark of stumps on the edge of woodland; and in various other types of shelter. The largest number ever found in any small area was six curculios in a small section of corn cob lying in a ravine close to a badly infested orchard.

#### Temperature and Rainfall Determine Appearance of Insect

THE INSECT starts to leave its winter quarters about the time that the blossom buds of the apple are turning pink, or in central Illinois in many seasons not until the blossoms are beginning to open. The time of their coming depends on the temperature and rainfall. Usually the greatest numbers appear when a

warm, sunny period follows a rainfall, and their greatest period of abundance in the spring is usually from the time of petal fall to about three weeks thereafter.

There is another curculio which works on apples and closely related wild hosts. It is seldom as important an apple pest

#### Summer Adults Feed on Growing Fruit

BY THE TIME the apple drops, the curculio grub is nearly or quite full grown. After a few days it eats its way out of the apple, works down into the soil to a depth of two to four inches and here excavates a very small earthen cell and in this changes to a soft-bodied pupal stage and emerges from two to three weeks later as a full grown beetle. At this time they are approximately one-fourth of an inch long, dark brown in color with grayish patches on their back and four slightly raised humps on the wing covers. A small curved snout about one-third the length of the insect's body projects forward and downward from the insect's head, the jaws being located in the tip of this snout.

These summer adults feed on the growing fruit, eating small pits and cavities in the sides of the fruit. In the more southern apple growing areas a part of these summer adults mate and lay eggs in the apple which produce a second brood of the insect. In the more northern areas,



Two Stages of the Plum Curculio.  
The damage is done by the full grown beetles and the grubs. The pupae are inactive and remain in the ground.

proper timing of sprays in the control of the plum curculio on apples. It has been found in normal years when the beetles are emerging at the usual time that very

(To Top of Next Page)

# The Control of Pear Psylla

By W. C. DUTTON

Michigan Experiment Station

PEAR PSYLLA is a serious limiting factor in the production of pears in many districts. It causes injury and unpleasant results in several ways. The nymphs of this insect feed on the tender growth, sucking out the plant juices and in that way using up elaborated foods that are needed by the pear tree for wood and leaf growth, the formation of fruit buds and the

honey-dew grows a black fungus that gives psylla-infested orchards a sooty appearance when the leaves are off. This honeydew also makes picking or any other operation in the orchard very unpleasant.

The final results of psylla injury are: small fruit of poor quality and appearance which does not keep well; premature loss of foliage with the failure to lay down desirable numbers of fruit buds; the death of many spurs and a general reduction in vigor of the trees that finally renders the trees unproductive.

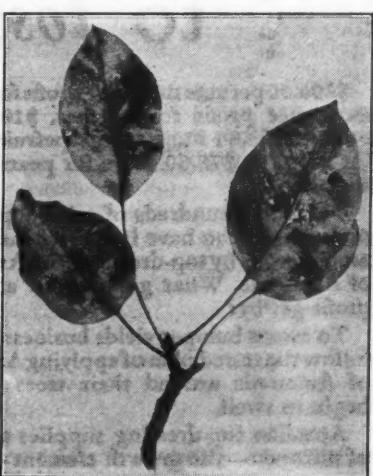
#### Insect Preferences

PSYLLA do not affect all orchards alike and it is difficult to explain some of the variations, but there are some conditions that are very favorable to psylla development. Psylla is not a lover of open spaces and much fresh air, and, because of this we do not expect to find as much injury in small orchards, in well spaced larger orchards on high ground or in windswept locations. Conversely, trees with dense tops, large orchards, especially closely planted ones, orchards protected by windbreaks or forest or those having air pockets may be expected to be badly injured by pear psylla. It is obvious, then, that these factors should be considered by any fruit grower who contemplates planting pears.

#### Development of Psylla

PEAR PSYLLA spend the winter in the adult or so-called "fly" stage. They hibernate in crevices in the bark of pear and other trees, in birds' nests, fence rows, rubbish on the ground, etc. They return to the pear trees in early spring and deposit their eggs usually in great numbers. These eggs hatch into nymphs about the time the trees bloom, and after molting several times, adults appear again. They lay eggs and then

(To Next Page)



Psylla injury on pear leaves.

production of fruit of good quality. They not only compete with the tree for food material but injure the leaves in such a way that brown spots appear and the leaves turn yellow and finally drop, so that severe defoliation may occur even as early as July first.

The feeding nymphs secrete, at certain times, large amounts of honeydew, a sticky sweet substance. This drips or runs onto spurs and fruits. In this

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February, 1930

satisfactory commercial control can be obtained by applying sprays at the time of cluster bud, petal fall, one week following the calyx, and three weeks following the calyx. These sprays should consist of four pounds of arsenate of lead in each 100 gallons of spray material, the spray material to contain the usual fungicide recommended for that particular locality and time, either lime-sulphur or Bordeaux, as the case may be.

Of these sprays, the calyx and one week sprays are, in the average year, the most important. Omission of the spray one week following the calyx may make a difference of 25 to 35 per cent in the amount of curculio injury occurring in the orchard. It is also highly important that a strong poison be used in these sprays, and under mid-western conditions four pounds of arsenate of lead to each 100 gallons of spray material should be used.

#### Spraying Very Important in Curculio Control

**J**IN 1929 experimental work on the control of this insect in western Illinois brought out very clearly the importance of this spray schedule in curculio control. A large check plot in the experimental orchard showed 99 per cent of the apples injured by the plum curculio. A sprayed plot immediately adjoining this check, where the curculio was fully as abundant and where the above spray schedule was followed, showed 3.6 per cent of the fruit injured by curculio.

During the past several years, very careful experiments on the control of the curculio have been carried out in Connecticut and their results conform very closely with those obtained in the central west. They have obtained consistently good results by a four-spray schedule, consisting of pink, calyx, seven-day and two weeks applications, the only difference in their recommendation being the use of a spray one week and two weeks after petal fall instead of one week and three weeks, as we have found to give the best results under Illinois conditions.

Work carried on in western Illinois during the past five years has shown consistently good results where the calyx, one-week and three-week sprays with four pounds of arsenate of lead in 100 gallons of spray material have been used. In one orchard, where the owner applied a pink and calyx spray and the three-weeks spray, 68 per cent of the fruit was injured by curculio. Where a seven-day spray was also applied, the injury was reduced to less than 10 per cent.

With the above mentioned spray schedule, the usual second brood codling moth sprays should be applied, and these are of considerable value in reducing injury from the late feeding of the summer adults, or in reducing the second brood of curculio, where a second brood occurs. The main thing in curculio control on apples is to get the overwintering beetles immediately after they have left hibernation and before they have had the opportunity of laying eggs.

## The Control of Pear Psylla

(From Preceding Page)

#### Methods of Control

**M**ANY METHODS of attack have been and are followed in the control of pear psylla. These attacks have been aimed at the hibernating adult, either in the fall or spring; at the eggs laid on the wood in early spring; at the nymphs or even at the adults or "flies" during the summer period. Treatments at two stages have frequently been made. Because of failure to control under some conditions or in certain seasons, or because some of the materials are unpleasant to the operator, there has been a demand and need for more satisfactory methods of control.

#### Oil Sprays

**D**URING RECENT years a somewhat different mode of attack has been developed and has been used quite generally in several pear growing districts. This consists of an early spring dormant application of an oil spray. This procedure was developed first in Ontario, Canada, where pear growers had about given up in despair, but are now very optimistic about pear growing, insofar as the control of the pear psylla is concerned.

The way in which this treatment works is very interesting. It has been known for a long time that an oil spray would kill the hibernating adults provided they were hit. The spring laid eggs are affected to some extent by a covering of oil but this effect cannot be counted on for control. The greatest benefit derived from this application comes from the fact that the female adult psylla does not lay her eggs on wood that is covered with a film of oil. Just what happens then is not altogether clear, but they probably die without depositing the eggs. It is also known that the adults become oil soaked when crawling on the oil covered wood, and some of them are probably disposed of in this way. The main reliance, then, from this treatment, is in the prevention of egg laying.

#### Timing of the Spray

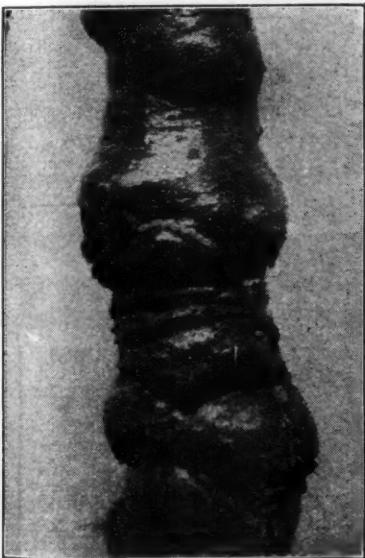
**S**INCE the principal object of this spray is to prevent egg laying, it is obvious that the oil should be applied before the female psylla begin to deposit eggs. The hibernating psylla begin to appear on the pear trees with the first mild weather in spring and egg laying usually begins with the first really warm period. This is usually in early April in the latitude of southern Michigan but often occurs in March.

The only safe rule, then, is to apply  
(To Page 31)

come more nymphs, more flies, more eggs, etc., so there is a complete brood every four or five weeks during the summer, and if the weather is favorable, these insects may be present in large numbers by late summer.

#### Vulnerable Points

**M**ANY INSECTS have few weak points in their life histories, that is, it is possible to kill them only at certain stages of development. With the pear psylla, however, it is possible to kill it in most any stage provided proper materials and methods are used. Several methods of procedure have been devised



Psylla eggs (enlarged). Psylla do not like oil covered bark as a place to deposit eggs.

and used because of the many vulnerable spots and it would seem that the insect should, therefore, be kept under control without difficulty.

Anyone who has had experience with this insect knows, however, that in spite of all its supposed weak points, it is one of the most difficult of insects to control. This is accounted for by the fact that a 100 per cent cleanup at any time is difficult and that the insect is so prolific that only a few in the orchard early in the season may develop into great numbers by fall.



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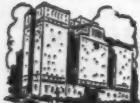
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# The Effects of Poison Sprays on Honey-Bees

By J. C. KREMER

Michigan State College

**O**VER in Soviet Russia it is the practice of some folks to gather fruit by the axe plan, or by the simple process of cutting down the tree. An easy way of getting what you want, but not advisable if you expect to harvest a crop the following year. Here in America we still have plenty of fruit growers who follow similar lines, but with a slight variation, by preventing the set of fruit so they won't have to cut down the tree. A seeming paradox but nevertheless quite true.

When some fruit growers persist in using arsenical sprays during fruit bloom or before full petal fall, either through choice or necessity, knowingly or unknowingly, they are depriving themselves

bees, the thinness of the crop and eventually the thinness of the pocket book.

#### Weather Conditions Influence Bee Flight

**T**HE ONE outstanding factor contributing to the poorly timed spraying of trees in bloom and the certain death of the honey-bee is the overlapping bloom of different varieties. A block or row of early blooming varieties, such as apricots, peaches, sweet cherries, plums or pears, may still be in full bloom or have 20 per cent or more of bloom left when such early varieties of apples as Duchess or Astrachan start to bloom. Midseason varieties like Wealthy, Jonathan, etc., may overlap the early varieties, and the late season varieties may overlap the midseason sorts. A cold, late spring with a sudden break to warm weather usually brings about this condition.

Now, supposing a block or row of stone fruits and the early apples had 20 per cent of their blossoms left and a block of the midseason varieties were in full bloom, the bees naturally would be working both varieties, if weather conditions permitted. If weather conditions up to this time had been unfavorable for bee flight, the chances for a good "set" of fruit would be small, as cold winds and wet weather hinder the bees to such an extent that their "time in the air" is negligible as far as cross-pollination is concerned. Warm weather arrives, more bloom appears and the early varieties have a large percentage of fallen petals. The fruit grower is getting anxious to apply the calyx application, but the bees are everywhere.

#### Poorly Timed Sprays Dangerous to Bees

**P**ERHAPS he misjudges the amount of bloom left with the bees still working them, and feels that the petal fall is far enough along to warrant the application of the calyx spray. Should he do so, a large percentage of the bees, the bumblebees, solitary bees and the nectar-loving insects are killed by the poison in that spray. He might better have waited a few days until the petal fall was more complete or at least until the majority of the blossom petals had turned three-quarters brown. After the blooms look quite brown, the calyx is still open, but the bees have usually stopped working that bloom because it has either become fertilized and ceased secreting nectar to attract the insects or has been nipped by frost and killed.

The brown color is not a safe criterion to judge the stage of bloom unless all the facts are known. Frost-nipped blossoms turn brown but unless killed outright they may continue to attract the bees because they have not become fertilized. A better way is to watch the bees, estimate their numbers or the amount of work being done. If few bees (on a warm spray day) are working the trees to be sprayed, no great damage will be done. Spraying with a "duster," however, is a "horse of another color" during an overlapping blooming period, and is the bane of the beekeeper whose bees have access to it. The poisoned dust will travel far from its intended destination and every flower it comes in contact with will be transformed from a "bee's delight" into a death trap.

When the fruit grower is using the poisoned dust for the calyx spray, upwind from the varieties in full bloom, the chances are even that the majority of the blossoms in full bloom are unintentionally transformed into death traps for the bees. When the dusting is done during a quiet spell, the danger is greatly lessened.

#### When to Spray

**I**N THE ARTICLE in this issue on "It All Depends On the Grower," H. A. Cardinell recommends a late enough application of the calyx spray to avoid poisoning the bees, and during a long cold overlapping blooming period when the danger from scab infection is great, to use a fungicide spray only, and

(To Page 34)

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## Some Substitutes for Arsenic in Codling Moth Control

By T. J. HEADLEE

New Jersey Experiment Station

**T**HE PRESENCE of undesirable spray residues upon apple fruit, when offered for market, is to be eliminated through removal by washing or by the use of insecticides which either leave no appreciable residue or residue of an innocuous character. Removal of undesirable spray residues by washing the fruit is already pretty well understood and this investigation has been concerned primarily with materials which may be used in the place of the common insecticides and which materials leave no undesirable residue upon the fruit.

Two materials of this character have received primary attention and some results of their use, as measured by control of codling moth obtained, are set forth. The materials in question are pyrethrum-impregnated white oil and a combination of nicotine and tannic acid known as nicotine tannate. The areas for field testing were so selected as to secure heavy infestation by codling moth.

### Experiments with White Oil Pyrethrum Spray

**T**HE WHITE OIL is a petroleum product from which practically all unsaturated hydrocarbons have been removed, likewise all particles and substances giving color eliminated, is water white, and has a viscosity of about 220 Saybolt at 100 degrees Fahrenheit. Extract of a little over three-fourths of a pound of pyrethrum flowers to the gallon was added to this oil or in some cases extracted with this oil. In 1927 a similar oil of lower viscosity and without any pyrethrum was used. In 1928 and 1929 this oil, with the pyrethrum added, was used. The tests made in 1927 were on Ben Davis; in 1928 on Star, Williams, Wealthy, and Stayman Winesap; and in 1929 on Winter Banana.

In 1927 the number of sprays employed was almost precisely the same as the number employed with the standard arsenical sulphur treatment. In 1928 the sprays employed began when one-half of the overwintered brood of codling moths had emerged and continued until entry by that brood ceased, involving three sprays all told. In the first spray one per cent of actual oil was used, while in each of the second and third, 0.5 per cent was employed. In 1929 spraying began when one-half of the overwintered brood of codling moths had emerged, continued throughout entry by larvae of that brood, involving three treatments, again one week before one-half of the first summer brood of moths emerged, and continued throughout entry by larvae of that brood, involving five sprays. All sprays in this case carried 0.5 per cent actual oil.

### Results of Experiments

**I**N 1927 there was some evidence of burning and a drop of nearly half of the set fruit. In 1928 serious chlorosis, especially on Stayman Winesap, appeared within a week after the application of the first spray. This variety dropped nearly half of its foliage and fully half of its set fruit. In 1929 there was no injury to fruit or foliage. The oil sprayed trees were much greener than the standard arsenical and sulphur treated trees. The average yield of fruit per tree was somewhat larger but the fruit buds for 1930 were smaller.

In 1927 up to September 23, the percentage of fruit injured by codling moth was approximately the same on the oil treated trees as on the standard treated trees. In 1928 the injury by codling moth on the untreated trees was a little less than that on the standard treated trees. In 1929 the standard treated trees showed 53.5 per cent free from codling moth injury.

This is an abstract of the paper presented at the Des Moines meeting of the American Association of Economic Entomologists. This paper is under the authorship of Thomas J. Headlee and Joseph M. Ginsburgh of the New Jersey Agricultural Experiment Stations, and Robert S. Filmer of Rutgers University.

and the oil treated trees 68.7 per cent free from codling moth injury. A study in 1929 of first brood codling moth injury showed a little less injury by codling moth to fruit on the oil treated trees than on the standard treated trees. The gain in the oil block was made during the attack on the fruit by second brood codling moth larvae. Against this brood there were five sprays of oil pyrethrum as compared with one spray of arsenic and sulphur.

### Outcome of Nicotine Tannate Experiments

**T**HE NICOTINE TANNATE employed was made by combining three pounds of commercial tannic acid and one pound of 50 per cent free nicotine in the spray tank with 100 gallons of water. Nicotine tannate studies did not reach the point where that material could be employed until the first cover spray for second brood codling moth was due. Six treatments of nicotine tannate were given to a block of Ben Davis in comparison with two treatments of standard arsenical sulphur sprays.

No injury of any kind attributable to the use of nicotine tannate spray could be found at the close of the season. The standard treated blocks showed 57.5 per cent of the fruit free from all codling moth injury and the nicotine tannate treated block showed 73.2 per cent free from all injury by codling moth. In addition, late broods of leafhopper had turned the foliage of the standard treated trees grayish while they had not affected the foliage of the nicotine tannate treated trees.

### Both Materials Give Promise

**I**N THE white oil-pyrethrum spray we apparently have a material that will hold codling moth fully as well as the arsenicals and leave the fruit in fine condition for market apparently free from residue. In the nicotine tannate we apparently have a material which will control codling moth fully as well as the standard arsenicals, prevent injury by certain other insects, such as leafhopper, and leave an innocuous residue, if any.

### How to Protect Dried Fruits Against Insect Pests

**I**T IS HARDLY necessary to point out that all dried fruits, whether bought commercially or prepared at home, should be stored in tight containers to protect them from insect attack. Adult insects of various species choose dried peaches, apricots, raisins, figs, and other fruits as suitable places for laying their eggs. These will soon hatch out into larvae or worms and make the product unfit for food.

To protect fruits from insect pests during the process of drying, the United States Bureau of Entomology advises that all fruit should be covered with a light cheesecloth while drying, to keep out dust as well as insects. An additional precaution suggested by entomologists studying the insects that attack stored and dried products is to sterilize the peaches or other fruits by heating them for a short time in a hot oven. This should kill any eggs that have been laid on the fruit, also any living weevils.

Another method is to fumigate each batch of dried fruit with carbon disulphide and then store it immediately in tight containers. The fumigation is accomplished by placing the fruit in a tight container and exposing it overnight to the fumes of the chemical. One or two ounces of carbon disulphide is sufficient to fumigate a space of 10 cubic feet. The chemical should be poured out in a shallow pan and placed on top of the fruit. The fumes of carbon disulphide are inflammable and fire in any form should be kept from the room in which it is being used.

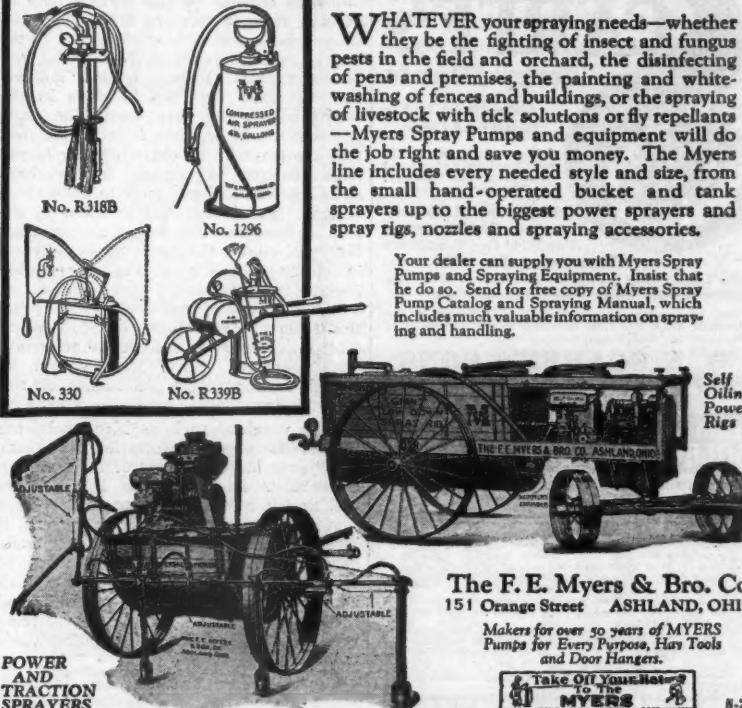
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## Don't Trifle with Rosy Aphis!

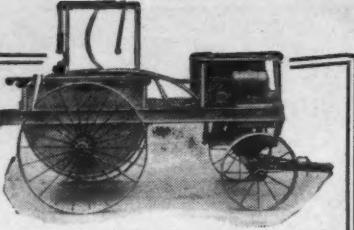
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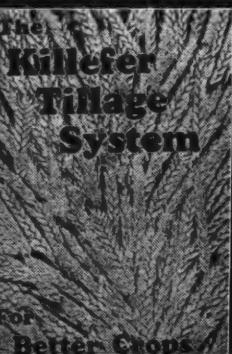
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## Recommendations for Oriental Fruit Worm Control

A RECENT conference of entomologists was held at Vincennes, Ind., to consider the results of the first season's work with this new fruit pest which has entered Indiana and Illinois and to make recommendations to fruit growers. Those who were present at the conference were F. H. Lathrop, W. P. Yetter, Jr., and R. F. Sazama of the federal Bureau of Entomology; Leslie Pierce of the federal Bureau of Plant Industry; W. P. Flint, M. D. Farrar and S. C. Chandler of the Illinois Natural History Survey; and J. J. Davis and L. F. Steiner of the Department of Entomology, Purdue University Agricultural Experiment Station. The following suggestions and recommendations are made to the fruit growers of Indiana and Illinois as an aid in combating this new pest which is one of the most serious problems confronting the growers at the present time.

Spring cultivation to bury larvae and pupae in cocoons on the surface may be of some value in reducing infestations and should be made before the first moths emerge, which would be before the first blooms appear. Results to date indicate that the later this can be done in the spring before the first bloom the more effective it will be, since it is at this time that the majority of overwintering larvae have changed to pupae. The orchard should be disked both ways to a depth of at least four inches and as close to the tree as possible. The use of an extension disk will enable the operator to cultivate in close proximity to the tree trunk. Picking up the drops and removal of nubbins is considered a desirable practice from the standpoint of fruit worm control as well as in the control of certain fruit diseases. Such fruit should be buried with at least six inches of soil over the top.

Late peaches, such as Krummels, are subject to severe infestation and may carry over large numbers of fruit worms. Orchardists having a few late peaches will find it advantageous to remove such sources of late infestation. In general, it is advisable that peaches be completely harvested and that the peach season be completed with the Hale harvest. If this is done, and the nubbins removed, and the drops picked up and destroyed, there will be less need for early spring cultivation.

It would be advantageous in fruit worm control, as well as in brown rot control to remove seedlings.

Interplanting of peaches and late apples is a dangerous practice from the standpoint of fruit worm infestation.

Late fertilization seems undesirable as it provides succulent growth in which the worms may continue breeding even after the fruit is picked.

Heavy lime sprays have some promise, but results to date show danger of excessive residue and insufficient control on early peaches. For these reasons the lime or talc sprays are not now recommended.

A long series of tests with baits, including ferments, aromatics and fruit juices, show promise of obtaining an attractive bait. Also a desirable bait trap is being developed. However, with the results from only one season's work and the rather larger initial cost in installing bait traps, they cannot yet be recommended, until it is shown that such traps not only catch large numbers of moths, but also reduce injury to such an extent as to pay a profit on the operation.

Banding catches some worms late in the season, but results to date do not show their practicability.

Paradichlorobenzene treatments, as for the peach tree borer, should be continued. These treatments are quite effective in destroying the oriental fruit worms hibernating on the trunk of the tree near the surface of the soil.

Twig pruning, that is, clipping of infested twigs, seems to be of questionable value under the conditions of most commercial orchards.

Packing-house sanitation and the disposal of cull fruit by burying with a six-inch covering of soil are factors which should be given careful attention as in codling moth control. The packing house,

the dumping grounds for cull fruit, old picking baskets, etc., serve as important sources of reinfestation from year to year.

The preliminary results with parasites introduced from New Jersey this past season indicate their probable efficiency

after they become thoroughly established. While we anticipate considerable value from the introductions of parasites, they cannot be expected to provide complete control and growers must plan to adopt practices such as have been suggested above.

## Consumers Guided by Appearance of Canned Fruit

By STANLEY JOHNSTON

Michigan State College

THE WESTERN canners have capitalized on the fact that the consumer buys "with the eye and not with the mouth." Two outstanding examples are the clingstone peach and the strawberry.

The clingstone peach as a canned product has attained its present popularity mainly through appearance. When it is canned, its firm-textured flesh withstands the canning process and therefore holds its shape. The color is orange instead of a pale yellow, and the syrup is clear. On the other hand, the freestone peach breaks down under the canning process. The edges of the peach are frayed, the color is pale yellow, and the syrup is cloudy with particles of the flesh. As far as eating quality is concerned, a majority of people, if allowed to sample the two canned products, would undoubtedly select the freestone peach.

The Ettersberg 121 is a famous strawberry in the Pacific Coast States. It is firm-textured and high-colored. The color extends entirely through the berry. Dur-

ing the canning process, this variety holds its shape and its color. The result is a fine appearing product when the can is opened. Strawberries that are white in the center rather than red lose the color from the outside of the berry during the canning process. The result is a pale, unattractive product.

Unfortunately for the strawberry growers and canners east of the Rocky Mountains, the Ettersberg 121 lacks adaptability. It does not succeed in the eastern and middle western districts and nothing else of equal merit is available at the present time. The strawberry varieties commonly grown in Michigan and New York, for instance, are probably of better eating quality than the Ettersberg 121, but they do not have the fine appearance after being canned.

These two examples emphasize the fact that the average consumer who knows very little about the merits of the article he is buying must be guided largely by appearance.

## Hairyroot a Specific Plant Disease

THE SEASONAL development of hairyroot and crown gall, their economic importance and the control of these and similar malformations have been followed at the Wisconsin Agriculture Experiment Station by A. J. Riker, W. M. Banfield, G. W. Keitt, the late W. H. Wright and H. E. Sagen, in co-operation with the United States Department of Agriculture.

The seasonal development of these two diseases has been followed on nursery apple trees for two years. For several weeks following inoculations, the symptoms of the two diseases are practically identical. After a month to six weeks the hairyroot enlargement sends out small fleshy roots. After three months, the hairyroot enlargement has produced a mass of roots, while the crown gall has merely enlarged and has produced no roots from the gall proper. In the second year characteristic hard enlargements are found in the plants inoculated with the hairyroot organisms, while in contrast the

plants inoculated with the crown gall organisms have ordinarily produced large fleshy galls, entirely free of roots.

The roots stimulated by the hairyroot organism have been found capable of supporting the life of apple, Delphinium, and Paris dairy plants after all other roots were removed. Whether the effects of the hairyroot organism on several plants over a long period are harmful or beneficial and whether this organism may be profitably employed in commercial propagation is now being studied.

The control of hairyroot as well as crown gall and wound overgrowths on piece-root grafted apple trees has been accomplished in a large measure by the use of adhesive tape as a wrapper on well-fitted grafts. Experiments examined during the current season, which involved over 40 separate trials in five mid-western States, have shown that, under the conditions existing this year, about three-fourths of the root knots at the union were prevented.

## Californians Advised to "Plant Nothing"

"PLANT NOTHING," is the advice of W. S. Killingsworth of San Francisco, for many years familiar with the California fruit growing industry.

"I'm not a Knocker," he said. "I'm just protecting the fruit industry and at the same time trying to save people a lot of grief. Too many acres of trees and vines are planted now. Let's take care of what we have until we open up additional markets."

"If you wish to go into the fruit growing industry go to one of the well tried fruit districts and buy a 'ready-made' orchard. You'll have no difficulty in finding such a location, with full bearing orchards and vineyards which you can buy reasonably for cash."

"Recent plantings of many varieties have been so extensive that production may be expected to increase for some years to come. The following statistics, compiled by the State Department of Agriculture, will throw a light on what is to be expected within five years, when present non-bearing acreage comes into full bearing:

"Peaches, all varieties, 17,300 acres; prunes, 14,217; pears, all varieties, 24,620; apricots, 10,802; figs, 7,648; almonds,

5398; walnuts, 39,291; grapes, all varieties, 10,078. Add the department's summary of 1,714,457 bearing acres in 1929, and it makes a grand total of 1,908,500 acres in California. There will be a tonnage to reckon with."

"In my judgment, the real solution is to adjust acreage so that, with normal yields, the right tonnage of various varieties will be produced. There seems to be no danger that this program would so restrict production as to make prices abnormally high, because, if prices are high in relation to cost of production, the grower's incentive is to increase production."

"However, an accurate adjustment of the tonnage output from any orchard cannot be calculated at any given time, because weather, insects, diseases and other factors cause large fluctuations from year to year."

"The surplus problem has been emphasized as the root of the fruit grower's difficulty. Surplus has a large effect on prices. Let production be regulated to the demands of the market, so as to safeguard the requirements of consumers and still maintain a profitable industry."

*H. L. Holdal, California.*

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February, 1930

## Raising Trees That Have Been Set Too Deep

By ARTHUR S. RHOADS

Florida Agricultural Experiment Station

**J**N PLANTING fruit trees, growers frequently make the mistake of setting them too deep in the soil. Fortunately, the tendency to set trees too deep is much less frequent at present than formerly. However, instances are still seen where trees are set so that the root crowns are buried as much as six or eight inches below the surface of the soil.

The effect of too deep setting varies somewhat with the type of soil, rootstock and kind of tree. Although trees with the crown roots below the level of the soil will live, they grow very slowly for several years and make backward and unproductive trees. Too deep planting of fruit trees predisposes them to a number of troubles. Deeply set citrus trees are especially subject to root rot and injury from a high water table. This is especially true in the heavier and more poorly aerated soils. In soils where the trees are subject to water injury, it is especially desirable that the bases of the trees be sufficiently high that there will be drainage from the root crown outward. Citrus trees set too deeply are also quite likely to develop exanthema (dieback) and mottle-leaf (fenching).

**T**HE TENDENCY of deep-planted fruit trees to send out roots from the scion is well known, some kinds doing this more freely than others. However, a number of years are often required for deeply set trees to put out roots from the buried part of the trunk, especially if the surface soil remains dry for long periods at a time. A marked improvement usually occurs in deep-planted trees following the development of this supplementary root system. The development of this additional root system may be stimulated by partially ringing the tree at or below the groundline and keeping the soil banked around the tree.

While deep setting usually results from planting by careless or uninformed persons, it often occurs as a result of settling of trees after planting at the proper depth, or by trees in low places becoming buried deeper in cultivation. Since trees usually settle somewhat after planting, it is desirable to have the soil bedded up more or less before the trees are set, in order to compensate for the settling of the tree as the soil becomes compacted. This is especially important in the case of citrus trees planted in muck soils, since a greater settlement takes place in such soils than in sandy ones. Each tree

should be planted at such an elevation that, by the time all settling takes place after planting, the root crown will stand at the same height in the orchard as it stood in the nursery. While it is not desirable to set trees too high, it is far preferable to have them set somewhat high than to have them set too deep in the ground.

**G**RÖWERS will find it a profitable operation to raise trees that have been set so deeply in the ground that they are not making the proper progress. This should be done preferably at a season when the trees are not making a vigorous growth and are not carrying fruit. The trees to be raised should be headed back lightly to compensate for the injury to the root system that is bound to occur.

The next step in preparing the tree for raising is to dig a tunnel-like hole under it, starting at a suitable point between the lateral roots on one side, about the length of a spade handle from the tree, and leading to a point from two to three feet deep where the taproot is encountered. The taproot, or its subdivisions, should then be cut with a long-handled shovel which has been filed to a cutting edge or by a chisel-like root-cutting bar which can be made by a blacksmith. The other roots need not be cut ordinarily and should be disturbed as little as possible. With the taproot cut, the tree can be raised by using as a lever under the root crown a stout pole or four by four-inch timber with about two feet on the working end rounded.

When the tree has been raised to the proper height, the soil should be tamped down around the taproot. The space under the root crown should then be filled in and a basin of soil thrown up around the tree and filled with water. Such precautions should enable the tree to withstand the shock of the operation, especially if the soil can be kept from becoming dry until the root system has had opportunity to become re-established.

Deeply set trees lifted in this way, with proper care, usually show a decided improvement. One Florida grower, who raised 416 of the deepest set Valencia orange trees in a block of 700 a distance of from six to eleven inches by this method, reports that none were lost and that, after recovering from the shock, they showed far more progress than the other less deeply set trees which were not raised.

## New Strawberry Variety Being Introduced

**A** NEW strawberry variety, the Blakemore, will be introduced this winter in the coastal plain section of North Carolina by the United States Department of Agriculture in co-operation with the North Carolina coastal plain test farm at Willard, N. C. The new variety is a cross of the Missionary and Howard 17, and shows a number of the good characteristics of each parent.

The Blakemore is a tart berry of the Missionary type with foliage more resistant to disease than either parent plant. It has a firmer berry than either parent but inherits its firmness from the Missionary. In hot, moist weather it does not puff and become soft as do the Howard 17 and most other varieties.

Berries of the new variety are a light, bright-red color, which is derived from the Howard 17, and unlike most varieties do not turn dark on holding, which makes this variety well adapted to preserving and market purposes. Like the Missionary, it grows well during the short days of winter and spring in the South, conditions under which the Howard 17 makes little or no growth.

After a thorough test in which a number of varieties were tried, the Blakemore has been selected by the National Preservers' Association as the most satisfactory variety for preserving. Reasons for the selection of this variety include its easy picking and hulling qualities, its bright, light red color, tough skin and firm flesh, solid center, acidity, high pectin content, and excellent flavor.

This variety is recommended for growing in the eastern North Carolina section

northward to New Jersey, and is suggested for thorough trial in all regions where either the Klondike or Missionary varieties are grown and in the southern part of the regions where the Howard 17 is grown.

## Harbor Terminal Ready in 1930

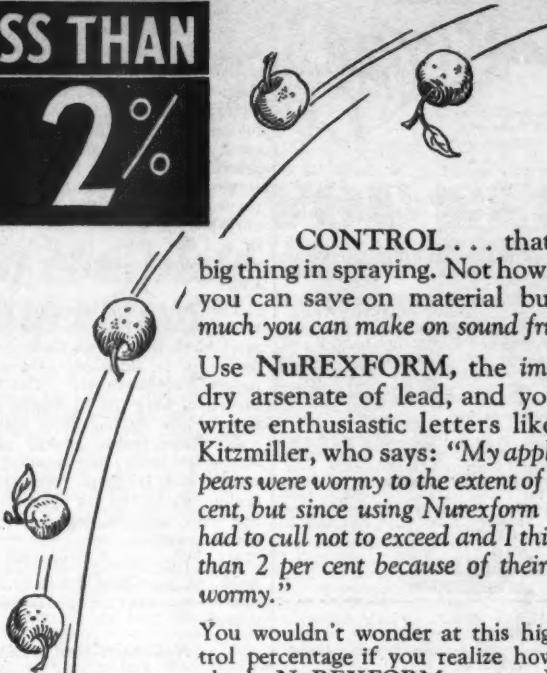
**W**ORK on the plans by the State Board of Harbor Commission for San Francisco harbor is under way for the State's pre-cooling terminal, it is announced by Governor C. C. Young. This announcement was made after a decision as to location had been made in favor of pier 46, near China Basin, as against Mission Rock.

It is hoped that the terminal will be completed and ready for use for the 1930 crop. The State will spend about \$250,000 on the terminal itself, and eventually about \$400,000 to \$500,000 will be spent.

Alexander R. Herron, State director of finance, said the terminal will have 1718 feet of ship space on one side and 801 feet on the other. This will provide space for four vessels of the largest type, he said. Some 420,000 cubic feet of refrigeration space will be ready for use next year and the space can be increased 50 per cent whenever the necessity arises.

The governor expressed his desire to help the fruit grower immediately and pointed out that there may be two or three other refrigeration terminals necessary within the next decade.—H. L. H.

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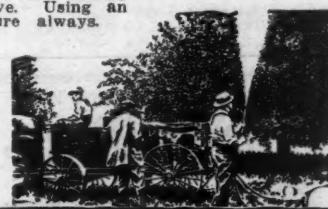
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To advertise we are going to give over \$7100.00 in prizes. Charles Hendling, between 50 and 70 years old, won \$245.00 in last offer; Joe Hanlick, 15 years old, won \$900.00; Mrs. D. H. Ziller won \$1800.00. You can win \$3500.00 now.

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Be careful! Don't make a mistake! It's not as easy as it looks because two, and only two, of the seven pictures are exactly alike. Find them—mark them—or send numbers on post card or letter. Over 25 prizes this time, and duplicate prizes in case of ties! Send no money. Anyone who answers correctly may receive prizes or cash. You can have cash or Waco airplane, or automobile, or new home. If correct you will be qualified for this opportunity.

**\$625.00 Extra For Promptness**  
making total prize you can win \$3500.00. Find twin flyers and send answer today. First prize winner gets \$625.00 cash just for promptness. Rush.

**I. D. SNYDER, Publicity Director**  
56 West Illinois St. Dept. 438 Chicago, Illinois



A tramp asked the proprietor of a circus for a job. He was informed that he could become a lion-tamer. He was assured that it was easy—that the whole secret was in forcing the lions to believe he wasn't afraid of them.

"No," said the tramp, "I couldn't be that deceitful."—Good Hardware.

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## Save 50% of Your Time



Cut the time you spend in orchards 50% and do better work.

That's exactly what fruit growers are doing who use the Clark "Cutaway" Bush & Bog Plow and Harrow.

For this implement does both the work of the mold-board plow and disc harrow in one operation. And does it better—in half the time.

The Bush & Bog Plow and Harrow plows up and disks the sod—turns under cover crops—keeps weeds down—mulches the soil.

Its usefulness doesn't end in the orchard for it does many jobs that would wreck ordinary tillage tools.

It's just the implement—the only implement—for working hard-baked soil, stubble land, old pastures, drained bogs and swamps, brush land, cutover woodland—any tough job.

The Bush & Bog Plow and Harrow is fitted with extra heavy disks of cutlery steel, heat treated and forged sharp. They're unconditionally guaranteed for 3 years against cracking or breaking.

Clip coupon for FREE catalog of tillage tools which includes other time-saving implements for fruit growers. Valuable book, "The Soil and Its Tillage," also sent FREE.

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**CHICAGO**

## Exterminating the "Medfly"

(From Page Eight)

Trypetidae, which are generally known as fruit flies. The apple maggot is a member of the same family. They have a sharp egg-laying organ which enables them to puncture fruits and lay the eggs beneath the skin. The cream-colored, footless maggots hatching from the egg work in the flesh of the fruit until full grown, when they leave the fruit and enter the soil for pupation, after which they emerge as adult flies. They are very prolific and complete their life cycle in a short time, in fact, eight or 10 generations a year may be expected in Florida.

This reason and the fact that they are well protected within the fruit during most of their life and thus protected from parasites is sufficient evidence of their potential importance. The host plants include a long list of fruits, although in Florida the fly has been found infesting only citrus fruits, guava, pear, peach, Surinam cherry, barbados cherry, white sapota and Maypop. All are cultivated fruits, with the exception of Maypop and sour oranges, which occur in abandoned areas.

For convenience in explaining the work, we may consider it to include three phases—quarantine, eradication and research.

### National Guard Assists in Quarantine Work

THE QUARANTINE includes those features intended to prevent spread. The quarantine problem being confined to a single State, it was possible to utilize the State National Guard for quarantine service. This is probably the first time the National Guard has been called upon to take charge of an insect quarantine, and from observations of the methods and effectiveness of the National Guard under the direction of Lieutenant Colonel Ayers, it is certain that this method has many advantages and that this service from the army in times of peace is highly desirable.

The service from the National Guard in maintaining a quarantine includes not only a thoroughgoing quarantine of the highways leading out of the infested region, but also the inspection of baggage going out over railroad, steamship and airplane lines. In addition, they are empowered to maintain the screening of salable fruit and fruit-carrying vehicles.

### Success of Eradication Gauged by Bait Traps

THE PHASE of the work which is of greatest importance in solving the problem as planned is that of eradication. The eradication program includes first of all efficient scouting to detect every infestation, for the success of eradication depends on locating every infestation. This is accomplished by the systematic use of bait traps. No satisfactory attractive bait has been found for the female flies, but, strangely enough, the male flies are strongly attracted to kerosene oil and therefore about 7000 traps have been scattered in orchards and elsewhere throughout the area. These are carefully followed and certainly should be continued until July 1, 1930, even if no flies are found in the meantime. These bait traps, which are operated as a phase of the research program, are more especially of importance as a means of gauging the efficiency of the campaign by measuring the adult population.

In addition, a thorough and systematic examination of the fruits, especially "drops," is being made to detect the first evidence of infestation, should any occur. To date such studies have failed to reveal a single infested fruit since August 27 or a single fly since August 7.

### Poisonous Spray Applied to Trees

IT IS ALMOST too much to expect that some infestations may not turn up between now and June 30, 1930, but certainly the eradication program must be recognized as highly efficient and praiseworthy.

As already stated, our observations would lead us to believe that the reduction in fruit fly infestation is largely, if not entirely, the result of the spraying

and clean-up operations. The spray used was a poison spray consisting of molasses, sugar, arsenate of lead and water and was not applied over the entire tree, but "shots" from a spray gun were made in each orchard tree, using about a pint of the solution to a tree. Similarly, shots of the solution were made on other trees, especially those along roadsides and near orchards.

While this spray is not exactly an attractive material, the flies find it without difficulty and relish the sweetish fluid which proves to be highly poisonous. Some difficulty has been experienced, especially in orchards where the fertility has not been properly maintained, from burning of foliage by the spray. Sprays are now being developed which will probably eliminate this objectionable feature. However, during the emergency period, the use of this spray, even though it did burn some foliage, was justifiable.

### Susceptible Fruits Destroyed

THE CLEAN-UP operations were unusually thorough. All citrus and other susceptible fruits within a radius of a mile of every infestation were gathered and buried in pits, with a layer of lime and three feet of soil as a covering to eliminate any possible emergence of the flies. In some cases non-commercial trees and other plants with fruit susceptible to infestation were destroyed. To be sure, some plants were destroyed which did not bear fruit likely to be infested, as shown by later observations, but here again we must recognize this problem as one which involved the safety of Florida's most valuable crop, oranges and grapefruit, and the program called for the utmost efforts to eliminate every supposedly susceptible fruit. The experience of the past season will enable the eradication forces to proceed with their program without the destruction of any fruits or plants which are not definitely known to be hosts.

In addition to the clean-up of cultivated areas and spraying, the eradication program has called for the destruction of all susceptible fruits, including sour oranges, in neglected places. Careful studies conducted over 600 square miles of wild land by the research division of the project have revealed no infestation in the native wild fruits. The original plans called for the removal of all wild native fruits, but since the studies of the past season showed none of these fruits to be infested, it is not necessary to attempt the removal of such fruits until they are proved to be hosts and therefore a menace.

### The Sterilization of Fruit

THE RESULTS of the research division of the fruit fly project are especially praiseworthy. Their work is necessarily the basis of any campaign of control or eradication. Their achievements include the utilization of the kerosene bait trap for the attraction of male flies and gauging the efficiency of the campaign, as already noted; the perfection of the poison spray to destroy the adult flies; the careful study of host plants; and, above all, the sterilization processes which appear to be so effective in destroying any infestation that may occur within the fruit. These processes are two in number. One is a cold processing of fruit, in which case the temperature is gradually lowered to 28 degrees Fahrenheit at a cost of about 20 cents per box. This method was the first

one suggested as a temporary measure until the other method could be perfected. The other process which offers greater promise and practicability is sterilization with heat. In this case the temperature is raised to 110 degrees Fahrenheit for eight hours. According to large scale tests already made, heat processing will cost between one and three-fourths and five cents per box and will produce better colored fruit and decrease rots during shipping.

### Work Directed by Doctor Marlatt

THE ENTIRE project is under the general direction of Dr. C. L. Marlatt, until recently chief of the Federal Plant Quarantine and Control Administration. The clean-up and quarantine

enforcement has been under the direction of Dr. Wilmon Newell, dean and director of the Florida Agricultural College and Experiment Station and has been conducted in a way which might well be recognized as a model for eradication programs. The research activities, which include studies of progress and hazards and development of methods and improvements, under the direct supervision of Dr. A. C. Baker, have developed results which are not only essential in the fruit fly eradication and control program, but form the basis of other insect problems and facts of value to the citrus industry in general.

It is to be hoped that facilities will be made available to permit a successful completion of the job undertaken and that the Federal Quarantine and Control Administration will be amply supported to enable it to prevent a return of this and other dreaded insects from foreign countries.

## Interesting Meeting Planned for Ohio Growers

R. G. PHILLIPS and Charles Milton Newcomb, nationally known speakers, are outstanding attractions for the sixty-third annual meeting of the Ohio State Horticultural Society, which will be held February 3 to 5 at the Horticultural Building, Ohio State University, Columbus, in connection with the annual Farmers' Week program. Twenty-two speakers are on the program with a variety of timely subjects on fruit production and marketing.

R. G. Phillips, secretary of the International Apple Association, Rochester, N. Y., will speak Wednesday on "Essentials of Marketing." The society is indeed fortunate to secure Mr. Phillips, who for many years has had his fingers on the pulse of apple marketing both in the domestic and export trade.

At a joint meeting with the Vegetable Growers' Association, also on Wednesday, H. A. Spillman, of the United States Department of Agriculture at Washington, will speak on "New Laws Affecting Containers and Produce Agencies." Mr. Spillman supervises the enforcement of the Standard Container Act of 1928 and the Produce Agency Act.

V. L. Saffro, of the Kay Laboratories in New York, will discuss the practical control of aphids. He is considered a national authority on this subject. The stationary spray plant, a new development for Ohio orchards, will be presented at the Tuesday meeting by William Abildgaard, of the John Bean Manufacturing Company, Lansing, Mich. Mr. Abildgaard has had wide experience in the installation of stationary spray plants throughout the country.

The meeting will be opened at one o'clock Monday afternoon by Dr. L. A. Stearns, entomologist of the Delaware Experiment Station, who will give an illustrated talk on "The Control of the Oriental Fruit Moth." Until last November, Dr. Stearns conducted the field experiments in oriental moth control for the Ohio Experiment Station, and by special arrangement is returning to give his encouraging results to Ohio peach growers. A number of growers from the society membership, as well as representatives from the University and Experiment Station, complete the list of speakers.

In co-operation with the Ohio Vegetable Growers' Association, the two societies are arranging a splendid line of commercial exhibits and these exhibits will also be seen in the Horticultural Building. Another feature of the meeting will be the Apple Show staged by the students in the Department of Horticulture at the university.

The annual Horticultural Society banquet is scheduled for Tuesday evening in Pomerene Hall on the University Campus. Charles Milton Newcomb, of Delaware, Ohio, nationally famous lecturer, humorist, and entertainer, will be the principal speaker at the banquet.

The secretary of the Ohio State Horticultural Society is F. H. Beach, Horticultural Building, Ohio State University, Columbus.

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## QUESTIONS & COMMENT

(From Page 15)

one or more of the following causes:

1. Cold weather injury occurring at bloom time or shortly after. This sort of injury is often known as frost injury. The surface of the apple may be russeted or made rough, or for the Gano and Ben Davis varieties, frequently raised portions or knobs may be produced as a result of the cold injury.

2. Sprays, particularly Bordeaux, when applied during cool weather may cause injury very similar to that described under number 1.

3. Insects such as codling moth and curculio by puncturing the skin of the fruit may cause the characteristic knobs or growth bumps on the Gano variety.

4. Mechanical injury such as limb rub may cause the skin of the fruit to present a roughened appearance.

From the description you give of your Red June apples, it is possible that the cause of the fruits decaying on the trees is due to the fungous disease known as bitter rot. Fruits affected by this disease have a tendency to hang on the trees after the fruit has decayed completely. This variety is also very susceptible to bitter rot, and it is suggested that for the sprays which are made during the latter part of June and up until about August first, they consist of Bordeaux made according to the 2-4-50 formula with arsenate of lead instead of lime-sulphur and arsenate of lead, because Bordeaux usually gives better control of bitter rot than lime-sulphur. It is, of course, important in this connection that the spraying work be very thorough and that the applications follow each other at no greater intervals than about 12 to 14 days and be continued up until within about four to six weeks of harvest time.

### Pear Infestation

In 1921 we planted a few Anjou pear trees. They fruited in 1928 and again in 1929, the crop in 1929 being larger than in 1928. In 1928, larvae of oriental moth or codling moth or both infested 99 per cent of the pears. In 1929, purposely to

avoid the above, I bagged the fruits early in August, a period which I supposed was too late for sprays as the sediment would dangerously linger on the ripening fruits in September and October. We escaped the worms, but inside of good looking pears appeared hard, dry, brownish spots that one man said was "stippled" and another "paylla." Will you please tell me the few details I need to know of these two, for never before, that I know of, has a Pennsylvanian said we had paylla. Also, will you tell me how to escape larvae in August or September in Anjou? Our Seckel pears escaped larvae, much to my surprise—J. R. B., Pennsylvania.

THE QUESTION that you raise is not easy to answer. In the first place, the hard, dry, brownish spots in the pears may not be due to insects at all. If you still have any of these pears I think that two or three of them should be examined, in order to be sure what it is that is really causing the trouble. I doubt if it is insects.

As for preventing injury by the oriental fruit moth, that's by no means a solved problem. A lot of work is in progress in several States to try to find a real means of control of this serious and rather new pest. Until someone works out a satisfactory control measure there is no final answer to be given to your inquiry. It is said that late sprays with so-called white oil have given promising results in some places this year. Heavy applications of hydrated lime in water, so as to give a coating of whitewash, are under study. Something will be worked out, we trust.

As for codling moth, the spray schedules followed for apples are recommended. Here again it is not desirable to apply late applications of an arsenical compound unless the fruit is going to be scrubbed. Many experiments are underway in the use of white oil sprays for the later broods of codling moth, and some good results are reported.

## It All Depends on the Grower

(From Page Eight)

insects, one-third to one-half of a complete dosage, applied every seven to 10 days, would give an "air tight" schedule that no pest could penetrate.

Every grower realizes that many obtain perfect economic control by four to six very heavy applications, well timed and thoroughly applied. Such heavy coatings of foliage and fruit leave an unnecessary residue that impairs the appearance or troubles the canners to remove it.

If the commercial grower of fruit crops knew how partial control of pests, year after year, has cut down the fruit set, size of fruit, color, and condition of the following year's crop, he would never again tolerate anything but a weekly schedule for the rainy months of spring. Ninety per cent of North American apple growers have acquired a habit of thinking and saying that "you can't afford to use nicotine more than once." A few of the most profitable orchards in Michigan receive a weak strength of nicotine sulphate in nearly every summer application. These orchards were not so profitable before these owners established such a schedule. It is better to be excessive and safe, than short and sorry.

### Making a Good Schedule Safe and Easy

HIS LITTLE outline, that is intended to make spray materials users better satisfied, needs only a rehearsal of a few suggestions that have appeared many times in past issues of AMERICA FRUIT GROWER MAGAZINE. Let us briefly review them:

1. Choose your weapons (method and schedule).

2. In applying your schedule, never allow more than 24 consecutive hours (not three eight-hour work days) to elapse between the start of an application and its completion. This rule holds for any schedule employed.

3. If you cannot cover this fast in daylight, mount lights and finish at night. The market cares not how the spraying is done, they buy results.

4. If day time and an occasional night's spraying will not give 24-hour pro-

tection, buy a duster or another liquid sprayer, put on a supply-waterwagon, put down more wells or anything else essential to increase cover speed and spray the earliest, susceptible varieties first.

5. If a poison is necessary before the full petal fall, make a late "pink" application even though it must be rushed. It is unfortunate that so many State schedules invite spraying for the petal fall period "when 75 per cent of the petals have fallen." During so many light crop-high price seasons the spring starts unfavorably. So often the last late blossoms may make a big proportion of the season's "set." Why not wait until all the petals have fallen and then employ methods that will cover every calyx before they close? Every grower could do this and save bees from poisoning. If disease is the problem, apply a fungicide during late bloom and repeat with a poison later. J. C. Kremer's article in this issue tells why and how.

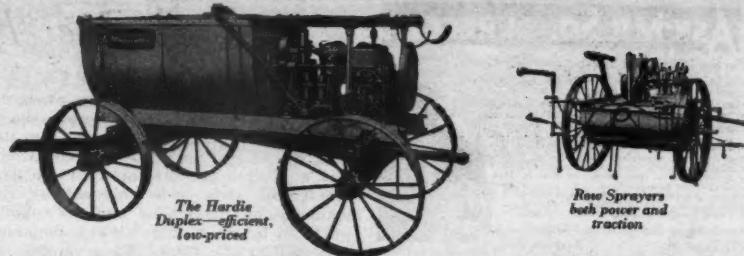
### Management Means Balance

**I**F YOU DOUBT the soundness of these recommendations and enjoy sportsmanship, allow your son or an employee to apply these suggestions to a part of your orchard and handle the balance as of 1929. In 1932, decide for yourself.

Let us not overlook the fact that spraying will not make up for a lack of pruning, feeding, pollination, organic-matter-water-reservoir, soil mulching, thinning, blight eradication or careful picking and handling. I wish to remind the student of this subject that the operator of an orchard is the only one in charge of the production program and, that, so far in our history, 90 per cent of the marketing results have been dependent on the production success.

Now, let us really spray in 1930—It All Depends on the Grower.

The thirty-seventh annual meeting of the West Virginia Horticultural Society will be held in Martinsburg on Thursday and Friday, February 13 and 14. The secretary is H. P. Sevy, Martinsburg.



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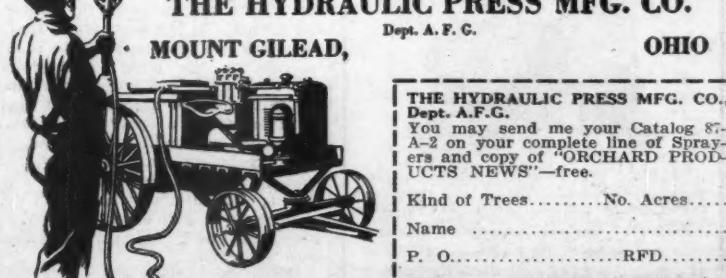
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## AMERICAN FRUIT GROWER MAGAZINE

# The Brown Rot Situation in 1929

(From Page 11)  
brown rot fruiting bodies were produced by such mummies. In most cases, however, the one-year old mummies on the ground produced no fruiting bodies. There was a marked contrast between the percentage of ascospores produced by the mummies on the ground and the conidia produced by the mummies which remained attached to the trees. In a number of cases the tree mummies had produced

fruiting area of trees treated in this way.

### Brown Rot Limb Cankers Studied

REALIZING the labor involved in pruning out cankered limbs, and the resulting loss of fruit, the writer undertook to determine the importance of these limb cankers in overwintering the brown rot fungus. At frequent intervals, hundreds of cankers on a number of varieties of peach trees were carefully examined for the presence of conidia. The old fruit pedicels persisted in many cases, as seen in Figure 2. These and the canker limb tissues were closely scrutinized for several days following each rain and not a single case of spore production was found on them, while at the time fresh conidial tufts were readily de-

moved of mummies from trees as the most important source of brown rot infection. With removal of the mummies, there will be far less summer spores to get into the fruit punctures made by cerculio and oriental moth.

### Destroy Mummies by Burning

ALL MUMMIES removed either from the trees, or from the ground under the trees should be taken from the orchard and destroyed, preferably by burning. Burning in addition to destroying the sources of overwintering brown rot, will also kill hibernating insects associated with the mummies. While deep burying might be equally effective in destroying the brown rot fungus, it would not keep the oriental



Figure 2. Cankers produced by the brown rot fungus growing from the decayed fruits through the pedicels into the limbs. While such cankers have been suspected of overwintering the brown rot fungus, not a single case of spore production was observed on hundreds of such cankers or dead fruit pedicels in 1929.

conidia before the first blossoms opened. This explains the source of spores from which the subsequent heavy brown rot infection of the blossoms developed in the spring of 1929.

When fruits nearing maturity are attacked by brown rot, the causal fungus grows rapidly, often spreading from the fruit through the pedicel, infecting the fruiting branch. There the fungus causes cankers, as seen in Figure 2. In some cases the limbs are girdled and the leaves above the cankers are blighted, with subsequent death of the limb beyond the canker. In other cases considerable wood about the base of the pedicel is infected without complete girdling of the limb. In such instances limb growth continues and new fruit buds are produced. The relation of these limb cankers to the overwintering of the brown rot fungus is important, because if it is necessary to remove the cankered limbs by pruning, numerous fruit buds will be removed. Such pruning may greatly reduce the



Figure 1. If undisturbed, a large percentage of these brown rot mummies would remain on the trees throughout the winter and produce fresh spores the following spring. During the winter when the trees are free from leaves, such mummies can be readily seen and should be removed from the trees and burned.

veloping on the mummies on the same trees. One season's observations are not sufficient to make a general conclusion, but they indicate that for Tennessee conditions brown rot limb cankers are not always an important source for overwintering the fungus, while mummies are. Therefore, the writer advocates the re-

moval associated with the mummies from the soil and causing further trouble in subsequent seasons, unless the fruit is well covered with freshly slaked lime or drenched with oil. The liming to be preferred for its destructive effect also on the brown rot fungus in the mummies.

## The Margin of Safety

### (From Page Seven)

orchard. Another method is to buy metal tanks, obtained from oil tank cars and install them at high levels as reservoirs. Water then flows through pipes to lower points in the orchard which serve as mixing stations. Any of these plans which increase the output of each machine tend to build a margin of safety without much increase in overhead costs.

### Conserving the Energy of Workmen

WHEN water and supplies are furnished to the spray machines, the men doing the spraying get a strenuous workout. Tired operators are less thorough in their spraying. Where it is necessary to have a driver for the team, he is sometimes trained to relieve the rest of the crew. The sum total of work performed at the end of the day is said to be greater when such relief is furnished. Moreover, the men are not so tired, and their attitude toward the work is better.

When trees are young, not much material is applied to a tree, and the operator travels may miles in the course of a day's work. It has been found that effective work can be done when he is allowed to ride on the tank. One prominent grower in Ohio has anchored a chair on the tank for the operator. He has provided him with a sprayer of large capacity and a gun with a large disk. Finding that horses walk too slowly in the younger orchards, he substitutes a tractor moving at intermediate speed. Again, more work is well done, and at the same time the energy of the workmen has been conserved.

When the various plans just described do not apply, some growers resort to

longer days in the orchard. They install gas or electric headlights on their outfitts at from \$22 to \$35. If it is too windy or rainy during the day, they spray at night. In critical periods, they put on extra men and work both day and night.

### Mammoth Portable Outfits

PORTABLE sprayers with tractor hitch and tanks of 400, 500 and 600 gallons' capacity are now available, as shown in the accompanying illustration. With a 30-gallon a minute pump, a tremendous gallonage may be applied in a day. These machines are being used on the Pacific slope.

One grower is considering this type of outfit in an extensive acreage of young trees from eight to 16 years of age. The land in his orchards is quite level. A water conveyor brings supplies to the sprayer. The outfit would cost much less than a stationary plant on this extensive acreage.

### The Stationary Plant

HAYWARD REED of Sacramento, Calif., devised a margin of safety for his pear orchard now known as the stationary spraying system. At flood time in the spring the river moved over into his orchard just when sprays for scab had to be applied. The spraying was completed on time by men working in rubber boots.

Probably the stationary spraying system provides the most comfortable margin of safety offered by any method of spraying.

1. There is less repair and machinery is therefore rarely idle.

2. There is no time lost in refilling.

3. The spraying program may be carried on when fields are too muddy for portable outfitts.

4. Teams, tractors and the men to drive them are free to do other work.

5. Finally, the amount of work performed by a given crew is increased from 25 to 50 per cent over the portable outfit.

Where so much depends on a central pumping unit, it would be taking a great risk not to have a pump in reserve in case of serious breakdown.

### Dusting Equipment

MORE DUST than spray material is washed off by rains. The remaining dust does not control diseases as well as the more adhesive spray material. It is impractical to dust for San Jose scale or for aphids. These facts are generally conceded with dusts now available. Dusting is, therefore, a supplementary measure confined to the summer applications with most of our orchard fruits.

However, dusting may be done much more rapidly. Ten acres may be dusted before breakfast or after supper. Thirty acres of mature apple orchard or 40 acres of peaches may be dusted during the day.

The saving in labor is absorbed by the added cost of dusts, yet the dusting outfit may prove to be a margin of safety. When excessive rains occur or warm weather causes an overlapping of two applications, the duster will provide the necessary speed to complete the job on time. In case of serious breakdown of sprayers, it then becomes an additional source of crop insurance.

Obviously, the finest dusts and the latest dusters will give greatest protection to the fruit crop.

pest invades in New England. Oils of some species are used three years in a row. Tendency to use these oils, while tendency to use them.

Extensive experiments in New York against roses have been made.

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## *Oil Sprays in the East*

(From Page Seven)

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either from the addition of overwintering mummification might be applied before the buds are very far out.

### *Combating Aphis, Red Mite and Scab*

WHAT is to be done when aphids, red mite, and scab are all present at once probably concerns the New England grower as much as any other problem in connection with oils. There are naturally several solutions. A stabilized oil with added fungicide and nicotine may be used, the effects of which are somewhat hazy as yet, judging from experimental evidence; or an oil may be used early followed by lime-sulphur plus nicotine (this combination has given good results), or the oil may be combined with nicotine to be followed later by lime-sulphur for scab control.

Under normal conditions, however, the eastern grower rarely has trouble from all three pests at once. Considering the McIntosh as the center of interest in this connection, we know that there is always danger from apple scab on this variety. Some growers feel that dormant fungicides are required (a little additional insurance), while others do not. We also know that aphids are rarely injurious in this variety as on, for instance, the Gravenstein, so that the two remaining factors in selection of a suitable spray are scab and red mite. Where one or the other of these two are abundant, the course is clear. When both are present, again two methods are open—oils and fungicide in one spray, or in two different ones; or, if mites are not severe, complete coverage with lime-sulphur. It is certain, however, that with some varieties, including Gravenstein, where aphids are usually severe, it does not pay to take chances—until, at least, more is known about such insects and the prediction of aphid outbreaks. We have seen too many cases promising no serious prospects for the grower only to see a serious outbreak, or cases promising serious outbreaks only to witness entire elimination of aphids by weather and enemies.

Another problem which interests growers in the New England States concerns the advantage of an oil emulsion over a strict miscible oil for dormant use. We believe there is no advantage in using a commercial emulsion over a miscible oil for red mite control and our tests so far have not shown up sufficiently well in the field (four per cent oil) to warrant recommendation at the strength used. Laboratory tests also indicate that with some emulsions a much greater concentration should be employed. Some emul-

sions giving good results with careful applications, have shown rather poor results in field tests and we have been forced to conclude that the trouble lies frequently with imperfect coverage rather than the actual killing power of the emulsion itself.

### *Oil Spray Injury Becoming Infrequent*

I HAVE NOT said much about injury from the use of oil sprays. That there has been injury and will continue to be injury from these products is self evident from the nature of the sprays themselves; but instances of this kind are becoming more and more infrequent due to gradual perfection of formulas and rigid standardization. There are weather conditions, however, when almost any oil spray will give some burn. Last year was such a year, at least in New England, the conditions promoting injury being the very sudden appearance of foliage and rapid advancement of growth before sprays could be completed. Yet in spite of the extensive leaf burn at this period, we have still to learn of an orchardist who experienced any permanent harm or who lost any proportion of his crop from oil sprays.

The above statement refers to apples. On peaches the burn usually takes the form of bud killing, but may be largely avoided if the applications are made before growth starts in the spring. On cherries we have never seen injury from use of the common preparations sold in the East. Plums and pears are apparently subject to a chronic type of injury appearing after several years of use, and even though such cases are hard to diagnose because of their similarity to other disorders, we believe some caution is needed in regard to these fruits. So much has been said about new or unknown preparations that it is hardly necessary to inject an added caution here. Suffice it to say that use of such sprays may be attended with serious results and we therefore recommend trial on a small scale of any new oil spray before using it on any considerable proportion of your orchard.

### *Summary*

THE USE OF oil sprays in the East has increased tremendously during the last 10 years, mainly because of the prevalence of the European red mite. In consequence, other problems have arisen, such as the combination of oils with fungicides and aphicides which have in turn reacted upon the oil spray business so that better oils are being marketed than ever before. The great variety offered has complicated the proper selection of oil sprays and careful consideration on the basis of cost, safety, toxicity, reliability and compatibility, is necessary. Much experimentation is needed in this field. Commercial oil emulsions have not proved to be better killing agents than miscible oils for red mites, a fact which deserves consideration, and, finally, studies of safety of the various products so far, indicate caution for pears and plums, together with additional caution on all fruits for the unknown product, especially if the formula is new.

## *The Control of Pear Psylla*

(From Page 23)

the oil with the first good spraying weather in the spring and, if possible, complete before egg laying begins. Spray very thoroughly, covering all portions of the tree and water sprouts or root suckers that may be present. It is advisable also to spray all interplanted and nearby fruit trees of other sorts.

### *Kind of Oil*

THE PREFERENCE with oils has been toward those of the heavy type, since persistence is the thing desired and heavy oils are generally supposed to be more persistent than lighter ones. Field tests have shown, however, that some of the medium oils are satisfactory, and it is probable that low volatility is an important factor in making them satisfactory.

Growers may prepare their own emulsions according to one of the commonly used formulas. There should be three per cent of actual oil in the dilute spray.

Injury to wood from oil sprays applied

### *Precautions*

THE GENERAL RULE concerning the use of oil sprays in relation to low temperatures should be followed with pears. Spraying when very low temperatures will follow application is not advised, and such a condition is very unlikely to occur. Do not spray when the temperature is at the freezing point, as injury might follow. This again is a seemingly unnecessary precaution, as most growers are unlikely to spray when the temperature is low.

Injury to wood from oil sprays applied

under proper conditions has been reported in a few instances but so far as the writer is aware, this has occurred only with trees in low vigor as a result of persistent psylla injury or possibly from unfavorable soil conditions.



HAYES Sprayers produce "Fruit-Fog"—the atomized super-spray—the pest killing mist so fine it seeks out and soaks into every hiding place that breeds crop robbing disease. Filters into every niche and crevice where air can go. Kills germs, disease, pests—instantly. 3-way "Fruit-Fog" guns (broad, medium and long spray) for row crop or tallest trees, need less solution, do a better job, save labor.

HAYES Triple and Duplex high pressure spray pumps are chain driven. Cast en bloc construction keeps all moving parts in line; makes possible lighter weight and eliminates leaky connections and gaskets; giant crankshafts insure perfected balance; long wearing brass and bronze cylinders have new, two-leather pistons for constant pressure and long life; finely ground wrist pins give double wear; drop forged connecting rods, with renewable bearings and bronze bushings, eliminate dangerous side-thrust. Monel metal gun discs insure six times more wear.

### *Write for Literature on "Tip-Proof" HAYES "Fruit-Fog" Sprayers*

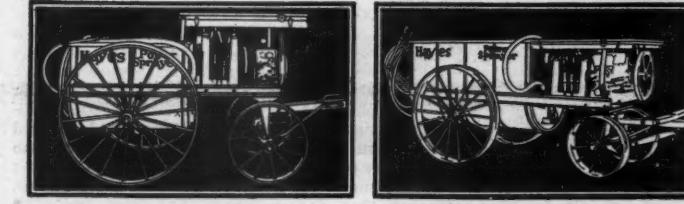
New HAYES underlung trucks, with cut-under front wheels, follow anywhere team or tractor travel. No danger of tipping on hillsides. Short turn for close work. Wide tires ride over deep sand and mud with lightest draft.

Four sizes of power rigs from which to choose—100, 150, 200, 300 gallon tanks with 1 to 3 gun capacities. Horse drawn or tractor hitch.

50 styles in HAYES Sprayers meet every spraying need from hand to the largest power outfit—each model the accepted standard of perfected spraying at low solution costs. Buy no spray outfit of any kind without first studying thoroughly the HAYES "Fruit-Fog" Sprayer literature. It is free. Write for it today.

HAYES PUMP & PLANTER COMPANY, Dept. 930, Galva, Ill.

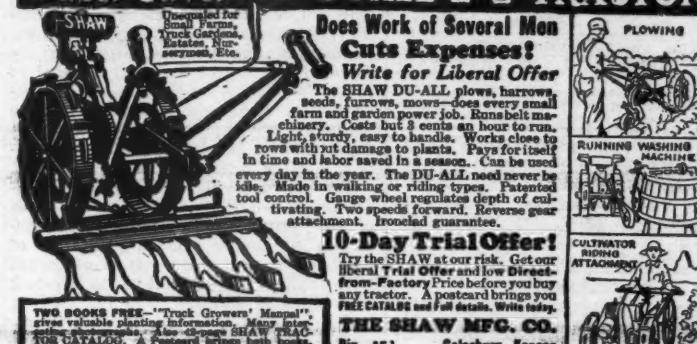
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Heavy duty for  
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Capacity 200  
gal. per minute.  
Pump weight 300  
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**\$5 to \$6 per Bbl. SAVING**  
on last year's prices of  
**SCALECIDE**  
THE COMPLETE DORMANT SPRAY

Tremendous price reduction makes the cost so low that you are duty-bound to use SCALECIDE this year

## *Get This Real Labor Saver—SHAW GARDEN DU-ALL TRACTOR*



under proper conditions has been reported in a few instances but so far as the writer is aware, this has occurred only with trees in low vigor as a result of persistent psylla injury or possibly from unfavorable soil conditions.

### *Supplementary Treatment*

THE ONE DORMANT application of oil gives control for the season in many orchards, but there are times when some supplementary treatment is necessary during the summer. For this purpose, the grower may use nicotine sulphate, one pint in 100 gallons of water, to which is added 25 to 30 pounds of fine hydrated lime or three or four pounds of cheap laundry soap or preferably potash

fish oil soap. The soap is especially desirable if the spray is made near harvest.

Another possibility is the use of an oil spray made from very highly refined oils. Several of the so-called "summer" emulsions are available but many of them are unsatisfactory in some way and the grower should determine the value of any particular preparation before using it. The best practice has not been worked out and much is yet to be known about the effects of these oils on pear trees, but they seem to be very promising. The best time to make a summer application is probably when psylla begin to appear in midsummer, although it may be applied to excellent advantage at a later date.

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COONHUNTERS—WILL SELL AT A BARGAIN one 4-year-old coonhound on long trial for \$25.00. Dr. Fred Bryant, East Prairie, Mo.

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OZARK FRUITS AND BERRIES FIND A READY national market. Every year thousands of cars of strawberries, grapes and fruit are shipped to all parts of the country. The size and quality of Ozark crops are due largely to ideal growing conditions in this famous region of Southern Missouri and Northern Arkansas. Gentle slopes, gravelly clay soil, abundant rainfall, mild winters, early springs and central location assure excellent returns. Poultry farmers and general farmers also enjoy excellent production and marketing facilities. Pure spring water. Healthful climate. Growing conditions unique. Good schools. Hard roads. Ideal homeland. Write for full information. C. B. Michelson, Colonization Agent, Frisco Lines, 834 Frisco Bldg., St. Louis.

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WANTED—HEAR FROM OWNER HAVING good farm for sale. Cash price, particulars. John J. Black, Chippewa Falls, Wis.

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MAKE BIG MONEY WITH CHINCHILLA Rabbits. Real Money Makers. Write for facts. 846 Conrad's Ranch, Denver, Colorado.

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PEACH AND APPLE TREES. \$5.00—\$7.50 PER 100 and up. Yellow Delicious and Blood Red Delicious apples. Small and large lots. Plums, peaches, cherries, grapes, nuts, berries, pecans, vines, ornamental trees, vines, evergreens, shrubs, fruit catalog. Tennessee Nursery Company, Box 101, Cleveland, Tenn.

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GENUINE MASTODON EVERBEARING, LESS than 1½c each. Catalogue free. Edw. Lubke, New Buffalo, Mich.

# The Bordeaux Insecticide Problem

By DWIGHT DeLONG

Ohio State University

**F**OR A NUMBER of years Bordeaux has been known as a fungicide and during the past few years has been thought to have insecticidal properties. A series of experiments reported in this magazine in the September issue seemed to leave little doubt regarding the fact that it is an insecticide for the potato and probably other leafhoppers. The evidence pointed very strongly to a toxic material in some form in the plant sap upon which these sucking leafhoppers feed. The assumption was therefore ventured that copper was being obtained from the plant juices.

After making this assumption, the first thing to determine was whether copper is really toxic to these insects when they feed upon it from known solutions. Various dilutions were therefore placed in feeding containers and the leafhoppers obtained the copper by sucking it through a membrane. A sufficient amount of food, however, was placed in these copper solutions so that the leafhoppers could survive for an average of 12 days if the copper was not present. It was found that substantial dilutions, such as a 1-5000 solution, gave an average survival of only 5.5 days, and other data showed copper to be a very toxic material when taken into the alimentary tract.

In order to find if the same results could be obtained when these solutions were obtained by the leafhopper through plant tissues, the roots of young bean plants were placed in these copper solutions and leafhoppers permitted to feed on these plants. In a few hours, in some cases, or a few days at the most, after the leafhoppers had fed on these leaves, they dropped from the plants and died. The leaves were then removed, the plant juices expressed from them, and copper precipitated from this plant juice. These tests showed to a marked degree that copper was highly toxic when obtained from plant juices by the leafhopper when it was feeding normally.

If Bordeaux spray mixture was made and allowed to settle for two hours and the clear supernatant fluid siphoned off, it showed no toxicity to leafhoppers allowed to feed upon it. Neither did this solution give a copper test. The leafhoppers survived on this solution, when suf-

ficient food value was added, for as long a time as they would on distilled water, if the same food value had been added to it.

Furthermore, Bordeaux spray residue when dry is practically insoluble in water, but in order to be effective as either a fungicide or an insecticide it must be rendered soluble. How is this accomplished?

It is known that sugar will readily dissolve copper from Bordeaux residue. Experiments have also shown recently that both potato and bean juices can dissolve out soluble copper from Bordeaux residue and absorb it through a semipermeable membrane. This may explain, to a degree at least, the method of rendering Bordeaux effective as a fungicide or an insecticide.

When Bordeaux residue was placed on filter papers and rain water was permitted to pass over it, the rain water showed no copper reaction. But when the same Bordeaux spray was put on the plant and the rain water obtained from the plant, it gave a positive copper test showing that soluble copper was being liberated on the plant, but not on these other materials. The plant therefore functions in some way as a solvent for copper from Bordeaux residue.

The plant also shows effects of Bordeaux spray. The evidence would point to stimulation, although certain authors claim that the plant is consistently injured. Recent experiments have shown that as a rule in both bean and potato plants the sugar content is decreased for about two days after application below the untreated plants, but after that time rises above the untreated and remains above for two or three weeks' time. Cook has found that in sprayed plants the percentage of weight of the tubers to the vine is higher on treated than on untreated plants which would be the natural outlet for the starch manufactured by the leaves. Many other workers have given evidence that points to a partial absorption of soluble copper by the plant. The data secured on insect toxicity also seem to point very strongly to this theory even though the points of the insect punctures may show the greatest concentration of copper when a test is properly devised.

## Undermining the Enemy

(From Page Five)

Institute is to help bring this about. The institute was organized eight years ago, under the auspices of the National Research Council. Its scientific membership includes a large number of the experiment station workers throughout the country. Its control lies with a board of governors, elected by the American Association of Economic Entomologists, the American Phytopathological Society, the Association of Official Agricultural Chemists, and the National Research Council.

The institute undertakes to direct well-organized research projects in the fields of spray materials, fumigants, insect control, plant disease control, utilization of by-products, and so on. It is concerned with application of chemicals to livestock as well as to plants.

All of its work is done through its cooperative relationships with State-experiment stations, State agricultural colleges, and established research laboratories maintained for the public welfare. It has sought to earn the confidence and respect of experiment station authorities and it has today close relations with stations from the Atlantic to the Pacific, from Canada to the Gulf. The men whom it employs as workers on its projects are placed in experiment stations and similar laboratories.

**E**ach Project Planned by Experts

**I**N EACH PROJECT that comes before it the institute draws up plans for the necessary work. It estimates how long it should run; how much help it will require, what other expense for materials, travel, or the like. On this basis it makes out a budget for the manufac-

turer to consider. If he decides to go ahead, necessary funds are deposited with the institute, which thereupon accepts responsibility for directing an orderly and careful study. The institute selects a committee of two or three scientific men to supervise the undertaking, selects whatever help may be needed, and takes charge of the work from that time on.

Under the system followed, the institute serves as the means by which the expert knowledge possessed by the manufacturer who is supporting the work is continually brought to bear upon the problem, to the end that the study moves forward steadily toward success. The scientific men who are identified with the project are benefited by their contacts with the experiment station men. The net result is a speedier, surer advancement of our knowledge looking toward more complete and satisfactory control of insects, plant diseases, and other ills that cause losses to American horticulture and agriculture.

### Successful Beginning a Promise of Continued Progress

**S**UMMING IT UP, the past five years have witnessed a definite, promising, and reassuring movement toward better utilization of chemical knowledge in the control of plant pests. The movement has already made marked progress. It is only just started. It is certainly gaining headway and it is going to see substantial improvements in the methods of warfare available to the American fruit grower and farmer. Insects and plant diseases are a destructive foe. But steadily and surely the advancement of knowledge is going to undermine the enemy.

### SPRAY MATERIALS

FOR SALE—NIAGARA SOLUBLE SULPHUR compound. Successful, complete dormant spray for scale, aphids and fungus. Write for special low prices. Chas. M. Ingersoll Co., Rocky River, Ohio.

FOR SALE—NEW MYERS POWER SPRAY rigs, complete with LeRoi and Novo Engines, porcelain lined cylinders. Good bargains for quick pick up. Chas. M. Ingersoll Co., Rocky River, Ohio.

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International Harvester Co. .... 11

### FERTILIZER

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## The Place of "Station Schedules"

(From Page Six)

grower fungicides that will prevent injury by fungous diseases and do no harm to the sprayed or dusted plants.

It has been the object of the horticulturist to find or develop plants resistant to the attacks of pests and to determine the effect of applications on the plants. The engineer has designed, improved, and equipped machines for the effective use of chemicals as sprays and dusts. The growers have applied the practices unfavorable to pests and furnished the other workers with timely and reliable information regarding the severity and need for control of certain pests.

Through the combined efforts, therefore, of the scientific and practical workers, dependable and valuable spraying and dusting schedules have been built up.

### Schedule for Each Variety

**VARIETIES** of apples differ greatly as regards susceptibility to injury by diseases and insects and to russetting or damage by sprays and dusts. For this reason it seems feasible and probable that the better growers generally may soon adopt schedules or programs of spraying and dusting suited particularly to certain varieties. In fact, good growers in many sections have already adopted such schedules and the consensus of opinion is that the change is a forward step toward the production of better fruit at less cost. Moreover, station workers generally report such a tendency, and it is their belief that an intelligent use of sprays and dusts suited especially to the varieties concerned should prove more effective in the control of pests.

### Relationships

**A**GRICULTURAL experiment stations and the private corporations, by perfecting and continuing their relationships, will come more and more to know the satisfaction which always goes to the seller who has furnished the buyer with that which he really needs and which will give him service. To both, therefore, will go the support and praise of all the people with whom they work.

There is also another striking relation between the two kinds of work, which has more to do with keeping men in the service than any other factor. When either of these workers has performed a real

service to the farmer or the merchant, he is stimulated with a sense of satisfaction in that he has helped others in addition to earning his bread. He, therefore, works for the love of work, not necessarily because it is required in order to make a living. Both kinds of workers are imbued with the missionary spirit or a desire to serve.

### Sales Are Required

MUCH of our extension work is of such a nature that a sale of some sort is required in order that the grower may put into practice the teachings recommended by the station. For example, the horticulturist may emphasize the necessity of spraying to make the commercial orchard a paying proposition, but unless the grower buys a spraying outfit, spraying chemicals, and such other materials and implements as he needs, the specialist has not sold his orchard improvement idea. Neither will the fruit grower make a success of his orchard operations until he does invest in these necessities.

Where much of the work in agriculture as agents of all the people, representing a public institution, stops, the work of the business or private corporation begins, and one or more sales may be required to complete the cycle. It is, therefore, of paramount importance that the workers of both groups co-operate to the fullest extent if they are to be of the greatest service to those with whom they work and to the institutions which they represent.

Due to a lack of knowledge regarding the place, work, and need of the agricultural experiment stations and supply manufacturers, there has not been as free and as hearty co-operation between them, in some cases, as there should have been. In recent years, however, great progress has been made toward the development of better relationships and both organizations should make more rapid and worth while advancement in the future.

As long as agricultural workers and business salesmen continue to sell ideas and goods which are honest, sane, safe, and practical, both are builders and real factors promoting progress and development. It must also be said that they are of great value and growers cannot make rapid advancement if they are lacking.

## Where to Send for Spray Schedules

State	Institution	Address
ALABAMA	Alabama Polytechnic Institute	Auburn
ARIZONA	University of Arizona	Tucson
ARKANSAS	University of Arkansas	Fayetteville
CALIFORNIA	College of Agriculture, Univ. of California	Berkeley
COLORADO	State Agricultural College	Fort Collins
CONNECTICUT	Connecticut Agricultural College	Storrs
DELAWARE	University of Delaware	Newark
FLORIDA	College of Agriculture, Univ. of Florida	Gainesville
GEORGIA	State College of Agriculture	Athens
IDAHO	University of Idaho	Moscow
ILLINOIS	University of Illinois	Urbana
INDIANA	Agricultural Experiment Station	Lafayette
IOWA	Iowa State College	Amen
KANSAS	State Agricultural College	Manhattan
KENTUCKY	University of Kentucky	Lexington
LOUISIANA	Louisiana State University	Baton Rouge
MAINE	University of Maine	Orono
MARYLAND	Agricultural Experiment Station	College Park
MASSACHUSETTS	Massachusetts Agricultural College	Amherst
MICHIGAN	Michigan State College	East Lansing
MINNESOTA	University of Minnesota	St. Paul
MISSISSIPPI	Mississippi A. and M. College	A. & M. College
MISSOURI	University of Missouri	Columbia
MONTANA	Agricultural Experiment Station	Bozeman
NEBRASKA	Agricultural Experiment Station	Lincoln
NEW HAMPSHIRE	University of New Hampshire	Durham
NEW JERSEY	New Jersey State Agricultural College	New Brunswick
NEW MEXICO	New Mexico College of Agriculture	State College
NEW YORK	New York Agricultural Experiment Station	Geneva
NORTH CAROLINA	North Carolina State College	Raleigh
NORTH DAKOTA	North Dakota Agricultural College	Fargo
OHIO	Ohio State University	Columbus
OKLAHOMA	Oklahoma A. and M. College	Stillwater
OREGON	Oregon Agricultural College	Corvallis
PENNSYLVANIA	Pennsylvania State College	State College
RHODE ISLAND	Rhode Island State College	Kingston
SOUTH CAROLINA	South Carolina Experiment Station	Clemson College
SOUTH DAKOTA	South Dakota State College	Brookings
TENNESSEE	University of Tennessee	Knoxville
TEXAS	A. and M. College of Texas	College Station
UTAH	Utah State Agricultural College	Logan
VERMONT	University of Vermont	Burlington
VIRGINIA	Virginia Polytechnic Institute	Blacksburg
WASHINGTON	Washington Experiment Station	Pullman
WEST VIRGINIA	West Virginia University	Morgantown
WISCONSIN	Agricultural Experiment Station	Madison



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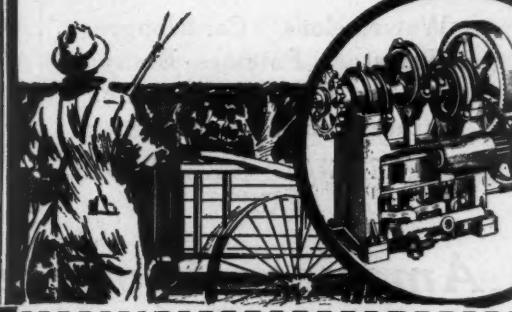


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## Effects of Poison Sprays on Bees

(From Page 24)

add the lead arsenate at the time of the calyx application.

During the long blooming period of last spring, H. J. Lurkins, county agricultural agent of Berrien county, Michigan, sent a notice to the fruit growers of the county reading like this: "Begin the petal-fall (calyx) spray now. Start with the varieties that have shed their petals first. Be sure that the petals are nearly all down and bees not working because it may be the last blossoms that will help to bring the crop." This notice was given credit in Berrien county for a fairly good set of fruit when none was expected and saved the owners of bees a heavy loss.

From a beekeeper's standpoint who is renting bees to an orchardist or from an orchardist's standpoint who owns bees, this spraying program should work out very satisfactorily. No beekeeper is will-

works both ways, but they never fly from one species of flower to another while on a nectar-gathering trip, as do the other insects, but may change to another, when one species ceases to secrete nectar.

### Cover Crop Bloom Exposed to Spray

WHEN THE sprayer or duster starts to apply the calyx spray, the flowers underneath are covered with poison and these flowers also become death traps. Here again the duster plays havoc with the bees' supply of nectar, especially if there is a breeze blowing the dust over the country side.

Sweet clover and buckwheat are being used in the cultivated orchards to some extent. When sweet clover is plowed under in the spring, but a very small per cent of it ever gets to the blooming stage, consequently the number of bees dying from poison is small. When the sweet clover is left uncut throughout the sea-



An overlapping blooming period. A poorly timed calyx application (liquid) is dangerous for the bees. Dusting, too, on windy days, under these conditions plays havoc with the bees.

ing to rent bees to an orchardist who is going to kill them with poorly timed sprays or who will not use precautionary measures. Bees and their equipment represent considerable investment and unless there are bees in flat equipment, no returns on that investment can be expected. Naturally, he desires to protect that investment, and it is not unknown that lawsuits develop over poisoned bees. The beekeeper usually wins the case and the fruit grower has "killed the goose that lays the golden egg."

### Cover Crops as a Source of Bee Poisoning

HERE is still a source of spray poisoning that usually is not given much consideration by the fruit grower and that is the kind of cover crop grown in the orchard. Orchards in sod are the worst offenders; those under cultivation to a lesser degree. Orchards in sod usually have considerable dandelion and clover in them, the dandelions blooming at the time of full bloom of the trees. If the season is late, a good percentage of the Alsike will be in bloom also. The dandelion is one of the best nectar and pollen-producing plants in the spring and receives considerable attention from the bees, though it has caused some beekeepers to break the Ten Commandments in several places when the bees refuse to avail themselves of the enormous quantities of honey present in them and work the fruit bloom overhead. Bees show a preference for fruit bloom nectar to that of the dandelion, but if the fruit bloom is not secreting nectar and the dandelion is, the bees work the dandelion and leave the fruit bloom alone for a time. If the bees start to "work" the fruit bloom in the morning they show a characteristic called "Flower Fidelity" by continuing to work the fruit bloom even though the dandelion is also secreting nectar. It

son the loss might be considerable. When buckwheat is planted early it will be in bloom at the time of the second codling moth spray and it is possible to have spray poisoning occur at that time.

It is not unusual to find cases of spray poisoning that are the result of poisoned cover crops. The writer knows of one beekeeper who suffered the loss of his entire apiary due to poisoned cover crops.

### Precautionary Measures

IT IS NOT difficult to avoid most cases of spray poisoning if a little foresight or thought is given the problem before spraying operations commence. If the bees are going to be a nuisance in the orchard after their use as pollinizers has passed, they had best be moved to some other location. If the fruit grower has bees of his own and does not care to move them off the place, his only recourse to prevent spray poison—providing the cover crop bloom is heavy—is to make a trip through the orchard with the mower and remove most of the bloom or confine the bees to the hive.

If the bees are confined to the hive during one of the dangerous periods, plenty of ventilation should be provided by removing the cover, screening the top with ordinary window screen and replacing the cover so that it will protect the top from rain but not prevent the free circulation of air across the top of the hive. As soon as the bees are all in the hive, at dusk, a lath can be nailed over the entrance. The bees should not be confined more than two or three days at a time.

Bees should be moved at least two miles from the old location to retain their full field force. Colonies moved within the boundaries of most farms should have grass or weeds thrown over the entrance to acquaint the bees with the fact that they must relocate the new position of their home.

## Bees

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